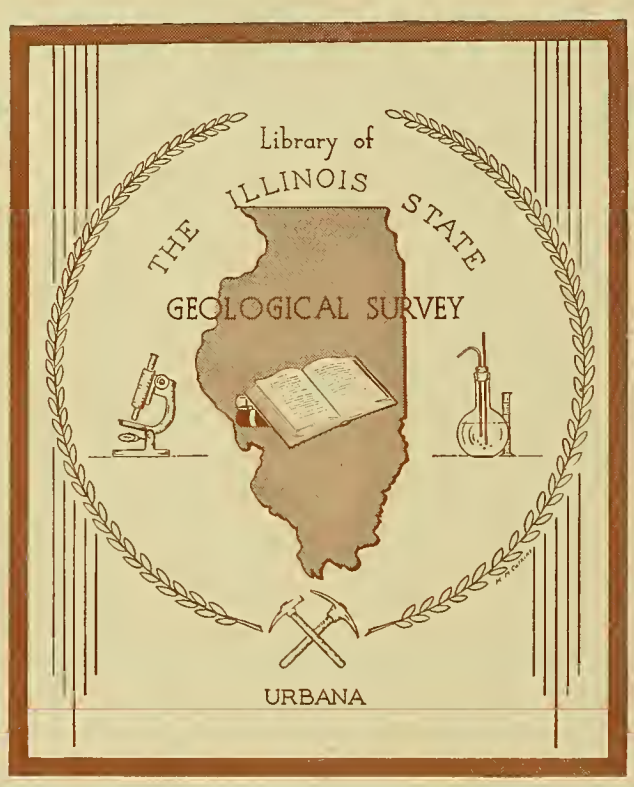

STATE OF ILLINOIS
HENRY HORNER, GOVERNOR
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*

REPORT OF INVESTIGATIONS—NO. 39

ILLINOIS MINERAL INDUSTRY IN 1934

A Preliminary Statistical Summary and Economic Review

BY

W. H. VOSKUIL and ALMA R. SWEENY

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1936

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TOPOGRAPHIC MAPPING

(In cooperation with the United States Geological Survey)

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ILLINOIS MINERAL INDUSTRY IN 1934

A PRELIMINARY STATISTICAL SUMMARY AND ECONOMIC REVIEW

WALTER H. VOSKUIL AND ALMA R. SWEENY

THIS REPORT, which presents the fundamental statistics in the distribution and consumption of the major mineral products of the State, is made possible through the cooperation of the United States Bureau of Mines and the United States Bureau of the Census, through the active collection and publication of coal statistics by the Illinois State Department of Mines and Minerals, and through the generous cooperation of the mineral producers of the State in complying with requests for information.

The quantity and value of mineral output in Illinois in 1933 and 1934 is shown in Table 1.

The mineral industry in Illinois is slowly rising from the depths of the depression and is responding to the gradually increasing industrial activity. Coal production has shown an increase, the oil industry has enjoyed higher prices than in the previous year and the resumption of building operations is bringing about an increase in the shipments of clay products. Improvements in the steel industry have favorably affected the fluorspar industry in Pope and Hardin counties.

The search for new and improved uses for minerals has resulted in the establishment of plants for the manufacture of rock wool and is contemplating improvements in the preparation of coal. Improved methods of oil recovery have met with favorable results and an increase in oil recovery by an extension of these methods may reasonably be expected.

TABLE 1.—PRELIMINARY SUMMARY OF PRODUCTION AND VALUE OF ILLINOIS MINERALS, 1933-1934

Product	1933		1934	
	Tons	Value	Tons	Value
Coal	37,413,145	$54,578,000	35,023,844	$64,238,000
Pig iron	1,269,940	20,063,481	.....	.....
Clay products	.....	4,145,033	.....	945,199
Coke	1,501,020	7,379,561	1,649,907	9,071,800
Cement (barrels) Portland	4,193,048	4,607,335	3,908,107	5,498,568
Sand and gravel (total)	6,107,829	3,370,039	6,174,202	3,373,690
Structural sand	724,368	325,852	606,354	302,558
Paving and road-making sand	1,109,710	503,952	1,014,805	419,832
Glass sand	402,240	403,578	448,804	449,832
Molding sand	223,241	209,272	347,078	320,242
Railroad ballast sand	132,720	46,802	161,348	65,774
Cutting, grinding and blast sand	99,135	275,294	107,366	334,953
Engine sand	44,503	22,048	39,000	21,546
Fire or furnace sand	[a]	[a]	[a]	[a]
Other sands	181,229	117,895	123,129	125,675
Structural gravel	576,309	312,134	602,212	315,864
Paving and road-making gravel	2,358,033	1,048,160	2,265,690	872,444
Railroad ballast gravel	383,290	144,809	291,166	62,193
Other gravel	47,892	20,610	167,250	82,777
Petroleum (barrels)	4,244,000	3,690,000	4,479,000	4,490,000
Limestone (total)	2,397,400	1,709,250	3,901,560	2,881,651
Road metal and concrete	1,759,490	1,191,538	2,667,242	1,963,405
Flux	135,190	76,394	257,650	149,225
Railroad ballast	126,220	85,447	228,517	150,263
Rip-rap	113,830	116,584	192,360	207,751
Rubble	[a]	[a]	68,450	47,690
Agriculture	221,250	161,122	448,810	291,761
Other uses	41,420	78,165	38,531	71,556
Mineral paints, zinc and lead pigments	12,539	1,268,853	.....	.....
Natural gasoline (gallons)	3,673,000	194,000	3,810,378	.....
Natural gas (M. cu. ft.)	1,631,000	951,000	.....	.....
Lime (total)	81,888	575,862	86,679	665,359
Building	11,799	93,919	14,113	120,079
Tanneries	[a]	[a]	[a]	[a]
Metallurgy	[a]	[a]	[a]	[a]
Paper mills	[a]	[a]	3,121	20,427
Other uses	70,089	481,945	69,445	514,853
Fluorspar	36,075	543,060	33,234	567,396
Quartz (silica)	52,230	273,526	50,748	285,849
Clay (raw)	72,447	197,532	69,921	160,537
Tripoli	8,757	149,979	7,417	119,418
Lead	240	17,760	40	3,160
Sandstone	.....	.....	3,900	5,761
Zinc	.....	.....	.....	.....
Total		$74,837,452		$98,268,729

[a] Included in other uses.

COAL

Review of production.—Coal output in Illinois in 1934 kept pace with the national increase of production over 1933. A preliminary report from the Bureau of Mines reports a total output of coal in the United States of 358,395,000 tons of which Illinois produced 40,905,000 tons, or 11.4 per cent. Final figures of coal production for 1933 and preliminary figures for 1934 are given in Table 2.

Table 2.—Summary of Coal Production in 1933 and 1934
(In thousands of tons)

Year	United States	Illinois	Illinois per cent of total
1933	333,631	37,413	11.2
1934	358,395	40,905	11.4

The production of shipping mines in Illinois, by months, as shown in the reports of the Illinois State Department of Mines and Minerals, is given in Table 3.

In view of the attempts to stabilize the production of coal by legislation among the several mining districts of the United States, it may be of interest to analyze the trend of production, seasonal fluctuations and changes in employment in the Illinois coal industry. The principal competing fields of the Illinois coal industry among the Appalachian fields are New River-Winding Gulf, Pocahontas and Tug River in southern West Virginia and northeast Kentucky, and McRoberts in eastern Kentucky, and frequent comparisons will be made with the trends in these fields.

TABLE 3.—BITUMINOUS COAL PRODUCTION BY SHIPPING MINES IN

County	January	February	March	April	May
Christian	374,167	349,883	331,161	221,986	239,099
Clinton	39,785	43,476	41,813	6,447	4,142
Franklin	787,405	733,572	811,116	431,576	367,836
Fulton	130,614	121,148	144,880	95,571	86,063
Henry	59,676	55,551	68,035	47,637	.....
Jackson	139,075	125,812	140,951	82,212	106,786
La Salle	20,805	19,009	20,478	12,725	.....
Macoupin	336,718	321,343	355,946	228,152	202,900
Madison	149,642	168,704	170,232	86,971	70,574
Marion	36,439	34,465	40,729	.....	.....
Montgomery	73,287	71,835	83,197	24,204	25,088
Peoria	135,364	126,462	137,547	93,630	82,799
Perry	290,527	294,418	291,499	213,406	192,125
Randolph	53,797	47,491	54,268	31,032	32,676
Saline	316,756	311,029	358,269	87,497	149,321
Sangamon	293,885	241,092	277,285	160,076	103,916
St. Clair	275,212	271,233	280,023	85,814	71,506
Tazewell	20,586	20,375	21,071	10,366	.....
Vermilion	160,666	174,437	191,779	140,468	112,187
Washington	28,682	27,021	30,187	15,008	16,563
Williamson	191,694	185,914	210,925	128,675	86,531
Woodford	15,208	13,162	14,088	3,162	.....
Other Counties	175,882	160,385	161,771	126,188	158,700
Total	4,105,872	3,917,817	4,237,250	2,332,803	2,108,812
Strip Mines	564,375	531,657	572,871	447,072	340,207
Shaft Mines	3,541,497	3,386,160	3,664,379	1,885,731	1,768,605

[a] Compiled from Monthly Reports of the Illinois State Department of Mines and Minerals.

ILLINOIS BY COUNTIES AND MONTHS FOR 1934 [a] (IN NET TONS)

June	July	August	September	October	November	December	Total
255,145	248,741	342,152	351,681	406,827	348,149	391,709	3,860,700
10,000	9,530	10,199	21,284	20,923	29,685	45,971	283,255
454,361	459,720	595,798	751,974	763,576	684,099	922,087	7,763,120
88,866	97,027	106,176	109,664	147,672	158,488	180,353	1,466,522
.....	.....	.....	38,266	48,867	41,797	41,511	401,340
126,532	117,092	143,169	125,726	127,182	124,019	119,589	1,478,145
.....	.....	.....	12,766	18,003	21,731	24,775	150,292
163,998	223,685	261,827	269,767	312,272	305,686	329,047	3,311,341
64,737	60,538	97,724	133,650	149,033	157,574	190,885	1,500,264
.....	.....	19,489	26,168	27,809	31,756	39,799	256,654
23,713	26,274	25,354	38,101	42,574	45,971	64,652	544,250
67,147	.....	84,065	89,212	123,284	104,729	135,331	1,179,570
193,265	201,310	206,134	229,781	264,601	238,467	357,697	2,973,230
26,491	22,389	20,228	30,264	36,201	36,112	48,839	439,788
108,026	134,610	202,079	201,905	243,690	234,721	353,036	2,700,939
82,848	122,346	113,903	168,125	173,904	181,660	275,804	2,194,844
64,238	69,011	115,324	173,087	186,355	201,125	259,707	2,052,635
.....	.....	15,613	22,519	20,332	22,014	27,973	180,849
116,687	94,094	110,693	101,230	134,718	155,537	175,583	1,668,079
16,367	20,489	28,436	23,556	32,343	29,976	40,312	308,940
91,811	79,306	102,656	176,495	190,510	195,157	232,102	1,871,776
.....	.....	.....	10,853	12,099	12,960	14,465	95,997
142,415	225,010	151,676	125,098	143,625	149,091	160,487	1,880,328
2,096,647	2,211,172	2,752,695	3,231,172	3,626,400	3,510,504	4,431,714	38,562,858
365,486	415,860	424,046	443,300	536,298	514,969	621,061	5,777,202
1,731,161	1,795,312	2,328,649	2,787,872	3,090,102	2,795,535	3,810,653	32,785,656

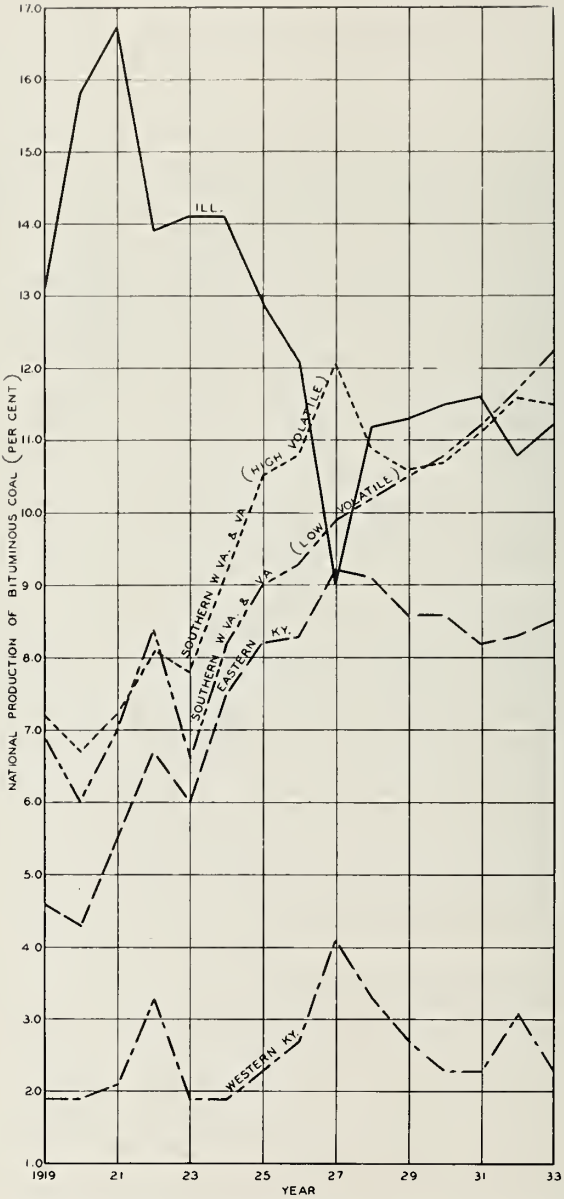

Fig. 1.—Percentage of Illinois' Share of National Production of Bituminous Coal Since 1918, as Compared With Three Competing Areas.

The portion of the national coal market from 1919 to 1934 shared by Illinois and some of the more important competitive fields supplying the Illinois coal market area is shown in figure 1. Increases are particularly noticeable in the high and low volatile fields of West Virginia and eastern Kentucky.

The shifts in percentages shown are of especial significance in the light of proposed legislation for the attempted stabilization of the coal industry.

The decline in Illinois production and the concurrent rise in output in the high and low volatile fields of West Virginia and the fields of eastern Kentucky, is, to a certain extent, the result of a differential in the wage scales in favor of the Appalachian fields. During that period, eastern Kentucky increased its proportion of the national output from 4.8 per cent to 8.5 per cent, the low volatile district of southern West Virginia and Virginia increased from 6.9 per cent to 12.2 per cent and the high volatile district increased from 7.2 per cent to 11.5 per cent. The average contributions of these three fields in the fifteen-year period from 1919 to 1933 are 7.41 per cent, 9.02 per cent, and 9.65 per cent, respectively.

The relative changes in the position of Illinois and its principal competing fields are summarized in Table 4.

TABLE 4.—PERCENTAGE OF TOTAL BITUMINOUS COAL PRODUCTION IN ILLINOIS AND COMPETING FIELDS, IN SPECIFIED YEARS

Field	1919	1933	1919–1933 Average
Illinois	13.0	11.2	12.67
Eastern Kentucky	4.6	8.5	7.41
Low volatile of southern West Virginia and Virginia	6.9	12.2	9.02
High volatile of southern West Virginia and Virginia	7.2	11.5	9.65

Long-time trends in coal output and employment.—Figure 2 shows the production of coal, the number of men employed, the number of days worked per year, and the output per man per day in the coal mining industry of Illinois from 1900 to 1933. Decline in coal production from the high peaks of 1916 and 1920 was to be expected as a result of the cessation of war time demands. Decline in the number of men employed follows, more or less, with the falling output during the post-war period. Even more serious than the lessened output and number of men employed is the decrease in the number of days worked per year. The annual income of the miner is a product of his daily wage and his annual working opportunity. The decline in working opportunity is partly the result of increasing summer volume of lake cargo coal from the Appalachian fields, and partly in increased output per man per day. In thirty years, the latter has increased from 3 tons per day to more than 6 tons.

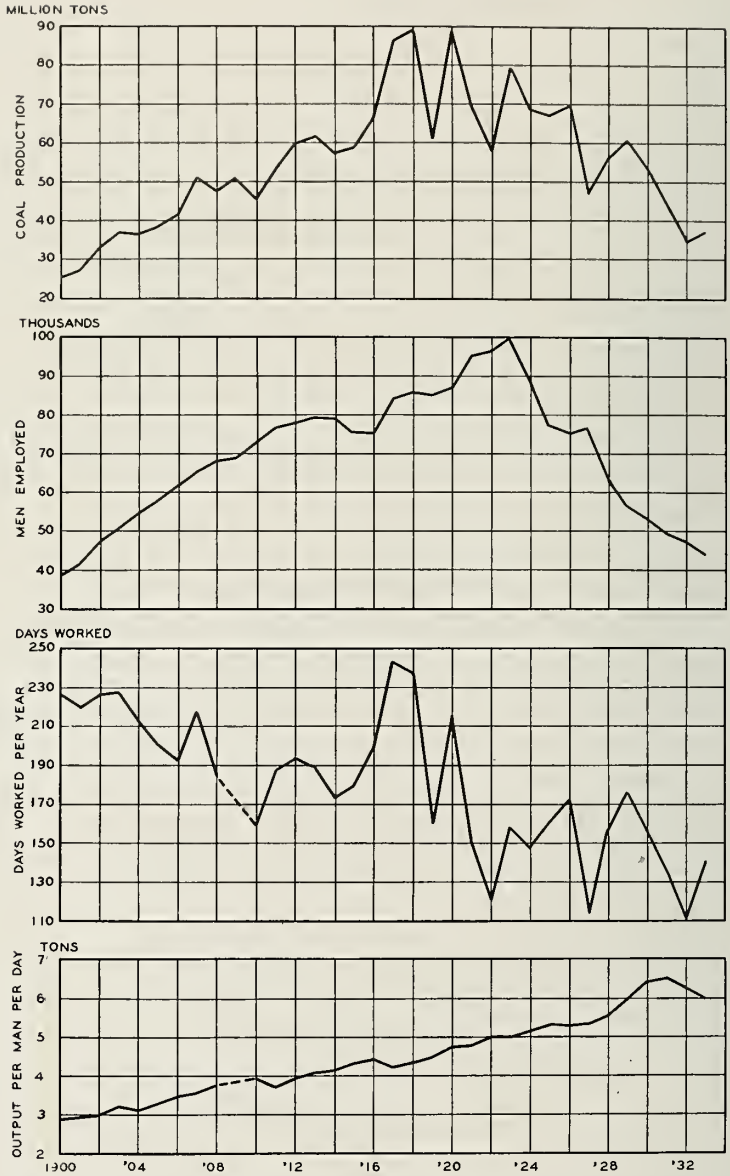

Fig. 2.—Elements of Long-Time Trends of Production and Employment.

Seasonal trends in coal production.—A contributing factor toward limiting the working opportunity of the coal miner in Illinois is the seasonality of coal demand. Figure 3 shows the average output of coal, by months, in Illinois, for the period 1917-1934 and fluctuations in employment for the same period. This seasonal fluctuation in the coal industry is particularly disadvantageous to the Illinois industry as compared with rival fields in West Virginia

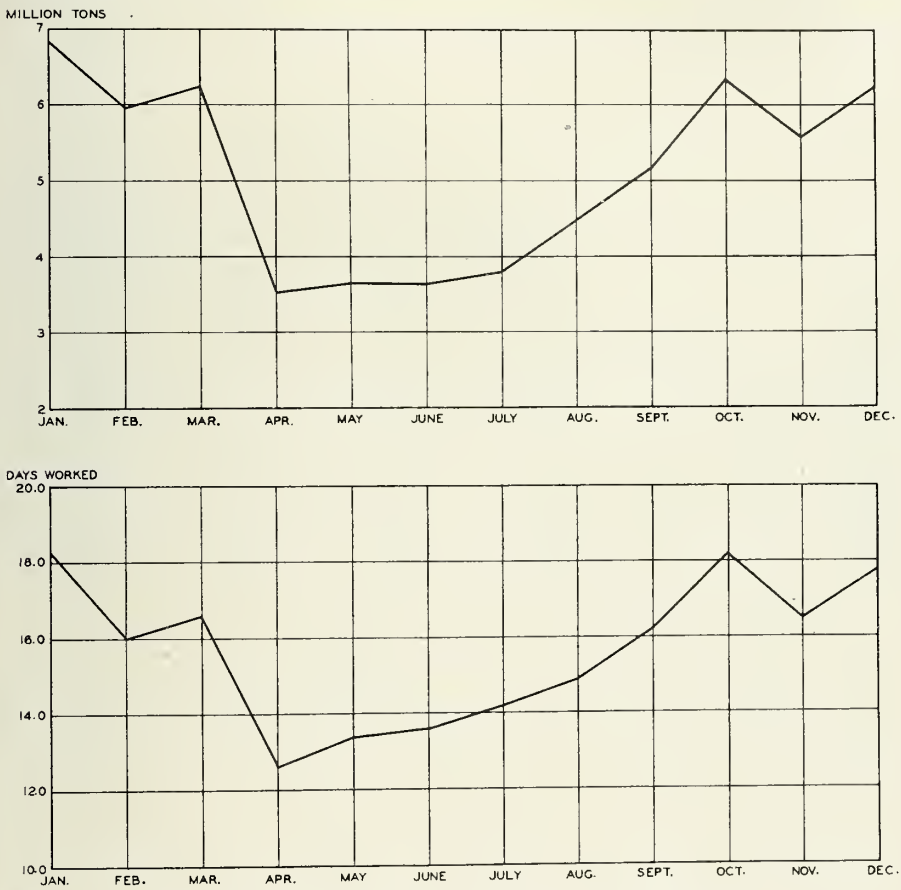

Fig. 3.—Average Production of Coal for the Period 1917 to 1934 Inclusive, by Months, and Fluctuations in Employment for the Same Period.

and eastern Kentucky, because of the influence of lake cargo coal upon the latter fields. This lake trade affords a summer outlet for coal produced in eastern fields. The lakes are closed to navigation because of weather conditions from some time in December until the following April and all coal moved by this route must be moved in the remaining part of the year. In that period the markets for coal reached by all-rail haul from the eastern fields are least active,

and the opportunity to maintain operation of the mines during the summer is welcomed by the producers. So well recognized is this fact that the larger producers in the eastern fields tributary to the lakes maintain organizations at the head of the lake with docks and equipment, and during periods when the market near at hand is dull these producers ship coal to the head of the lakes where it is stored on the docks awaiting the winter market. The producer is then enabled to operate his mines more continuously. The discrepancy in working opportunity between Illinois and Appalachian fields, as shown by Table 5, bears out this analysis.

TABLE 5.—TOTAL NUMBER OF DAYS WORKED PER YEAR IN COAL MINING IN ILLINOIS, WEST VIRGINIA, KENTUCKY, AND PENNSYLVANIA [a]

Year	Illinois	West Virginia	Kentucky	Pennsylvania
1917	243	225	214	261
1918	238	238	230	269
1919	160	200	189	218
1920	213	198	182	244
1921	152	149	152	151
1922	120	143	140	154
1923	158	169	152	213
1924	148	182	174	180
1925	161	225	206	200
1926	172	247	230	224
1927	114	235	237	203
1928	156	223	212	218
1929	177	247	222	230
1930	156	204	187	198
1931	136	176	159	160
1932	112	168	155	146

[a] U. S. Bureau of Mines, Mineral Resources of the United States, Chapters on Coal.

The pronounced seasonality in coal production in Illinois not only limits the annual working opportunity for miners but tends to raise the per ton cost of production.

Distribution of coal in the Illinois coal market area.—Table 6 gives a summary of all-rail revenue coal (exclusive of railway fuel) shipped into the Illinois coal market area by market districts since 1932. Shipments of Illinois coal have gained since the low period of 1932. Of interest is the substantial gain in coal shipments into the Wisconsin market area. The invasion of natural gas has curtailed shipments sharply in the Kansas City market in 1933 and 1934 as compared with 1932.

While the all-rail shipments of coal during these three years show a slight recovery of the market for Illinois producers, the movement of coal over the Great Lakes into the Illinois coal market area continues at a high level.

Table 7 shows total shipments of all-rail revenue coal into the Illinois territory and the percentage of shipments from Illinois for the years 1932, 1933, and 1934.

Tables 8 and 9 show the bituminous coal shipments to American ports on Lake Superior and Lake Michigan from 1929 to 1934 and the receipts of coal at Upper Lake Docks from 1931 to 1934.

In Tables 10 to 13 are shown the shipments of bituminous coal and anthracite to principal ports on the western shore of Lake Michigan and to the Duluth-Superior port on Lake Superior since 1920. The interesting feature of these shipments is the downward trend of anthracite. Before the World War, anthracite occupied an important position in the domestic fuel markets of the Lake Docks territory. The subsequent drastic increase in price of anthracite has stimulated the substitution of other types of prepared domestic fuels, notably coke, fuel oil, and briquets.

TABLE 6.—ORIGIN AND DESTINATION OF REVENUE RAILROAD SHIPMENTS FROM ILLINOIS, RAILROAD

From	Chicago	Illinois, other	Milwaukee	Wisconsin, other	Council Bluffs
1932					
Western Pennsylvania	325	86	126	226	.....
Altoona, Somerset-Meyersdale and Cumberland-Piedmont	12,417	3,813	242	1,814	588
Fairmont (W. Va.)	14,840	1,670	1,003	2,386	.....
Northern and Eastern Ohio	1,980	.....	150	770	.....
Southern Ohio	2,596	142	.....	50	.....
Kanawha, (W. Va.) Logan and Kenova-Thacker (W. Va.-E. Ky.)	825,727	178,434	4,206	70,537	3,621
New River-Winding Gulf and Pocahontas-Tug River (W. Va.)	5,942,825	375,706	158,848	535,263	202
Northeast Kentucky and McRoberts	491,950	220,571	1,479	70,290	288
Virginia	39,361	13,214	2,422	28,945	.....
Harlan and Hazard (E. Ky.)	1,030,422	514,807	4,469	60,264	1,838
Ex-River Coal	626	1,101	.....	.....	.....
Northern Illinois	603,657	1,244,808	.....	14,632	238
Central and Southern Illinois	3,862,441	5,454,889	11,297	321,495	94,237
Indiana	2,720,859	1,143,782	18,689	286,759	2,340
Western Kentucky	1,004,353	1,003,425	4,757	260,201	18,863
Total	16,554,379	10,156,448	207,688	1,653,632	122,305
1933					
Western Pennsylvania	3,964	50	.....	839	32
Altoona, Somerset-Meyersdale and Cumberland-Piedmont	29,667	5,324	383	2,040	561
Fairmont (W. Va.)	17,928	1,671	306	1,982	.....
Northern and Eastern Ohio	1,175	1,526	50	2,054	.....
Southern Ohio	2,010	.....	.....	.....	.....
Kanawha (W. Va.), Logan and Kenova-Thacker (W. Va.-E. Ky.)	854,811	127,639	1,486	57,419	1,953
New River-Winding Gulf and Pocahontas-Tug River (W. Va.)	5,908,215	392,942	194,074	532,527	149
Northeast Kentucky and McRoberts	696,218	225,820	1,894	62,523	91
Virginia	56,084	14,040	490	23,710	.....
Harlan and Hazard (E. Ky.)	1,294,290	385,414	3,286	53,118	1,250
Ex-River Coal	243	51	.....	.....	.....
Northern Illinois	623,439	1,216,138	154	16,812	.....
Central and Southern Illinois	4,922,351	5,219,466	10,872	409,127	45,241
Indiana	2,701,214	995,944	28,629	336,083	651
Western Kentucky	646,009	507,085	8,178	255,947	10,183
Total	17,757,618	9,093,110	249,802	1,754,181	60,111

[a] Data from Monthly Coal Distribution Report 32, U. S. Bureau of Mines, March, 1934.

INDIANA AND WESTERN KENTUCKY AND FROM THE APPALACHIANS (EXCLUSIVE OF NON-REVENUE FUEL) [a]

Iowa, other	St. Louis	Kansas City	St. Joseph	Missouri, other	Kansas, other	Nebraska, other	Minnesota	South Dakota	North Dakota
				1932					
1,379	102								
2,435	1,062	1,317	411	2,125	1,317	1,175	3,503	1,029	
3,054	52					155	651	361	
948							35		
166									
252,846	41,137	89		4,804	89	861	27,980	4,841	
87,114	73,317			637		81	223,095	32,900	
206,139	203,585			108		697	46,400	6,115	
5,213	52						9,068	461	
473,569	12,366		48	4,044		2,584	55,853	13,003	
178,236	209			192		32	119,518	892	75
1,295,142	2,883,363	12,739	21,707	928,259	21,504	136,741	326,604	105,697	482
303,999	70,638	101		9,106		7,127	124,287	2,772	148
621,262	426,477			287,788	240	19,662	146,432	58,895	3,392
3,431,502	3,712,900	14,246	22,166	1,237,063	23,891	169,115	1,083,426	226,966	4,097
				1933					
2,647	23			53				45	
2,786	2,074	638	248	1,846	1,199	1,278	4,223	1,149	
3,048				35		109	1,216	252	
1,870							238	293	
322									
208,094	42,586	43		3,191	35	340	31,207	4,299	
86,807	65,644		89	750	83	134	197,457	27,590	
170,380	179,463			868		412	40,154	7,747	
3,986	142						8,149	513	
425,256	11,251			2,750		1,133	45,069	12,312	
266,983							61,856	954	
1,288,290	2,630,143	4,343	14,759	816,659	15,202	103,930	297,789	81,235	672
282,932	60,246	105		4,134		5,021	137,232	18,649	584
398,858	123,562			152,053		16,303	96,904	35,678	2,885
3,142,259	3,115,134	5,129	15,096	982,339	16,519	128,660	921,494	190,716	4,141

(Continued on next two pages)

TABLE 6 CONCLUDED.—ORIGIN AND DESTINATION OF REVENUE RAILROAD SHIPMENTS FROM NON-REVENUE

From	Chicago	Illinois, other	Milwaukee	Wisconsin, other	Council Bluffs
1934					
Western Pennsylvania	19,858	1,530	340	496	.....
Altoona, Somerset-Meyersdale and Cumberland-Piedmont	31,455	4,674	413	2,586	772
Fairmont (W. Va.)	10,864	7,555	92	1,323	.....
Northern and Eastern Ohio	2,120	.....	.....	944	.....
Southern Ohio	3,201	280	.....	493	.....
Kanawha, (W. Va.) Logan, and Kenova-Thacker (W. Va.-E. Ky.)	865,362	105,197	1,421	42,798	1,274
New River-Winding Gulf and Pocahontas-Tug River	5,987,987	417,313	122,516	534,235	77
Northeast Kentucky and McRoberts	812,537	236,818	601	43,192	.....
Virginia	86,865	14,051	.....	25,941	.....
Harlan and Hazard (E. Ky.)	1,136,387	279,383	1,513	46,481	618
Ex-River Coal	.....	248	.....	.....	.....
Northern Illinois	660,261	1,720,818	162	53,130	44
Central and Southern Illinois	5,013,206	5,697,164	16,293	665,931	42,455
Indiana	2,778,257	1,005,808	46,403	471,015	1,466
Western Kentucky	560,775	334,767	1,442	301,323	7,707
Total	17,969,135	9,825,606	191,196	2,189,888	54,413

[a] Data from U. S. Bureau of Mines, Monthly Coal Distribution Reports.

ILLINOIS, INDIANA AND WESTERN KENTUCKY AND FROM THE APPALACHIANS (EXCLUSIVE OF RAILROAD FUEL) [a]

Iowa, other	St. Louis	Kansas City	St. Joseph	Missouri, other	Kansas, other	Nebraska, other	Minnesota	South Dakota	North Dakota
				1934					
521	.....	17	.....	.....	.....	.....	172	38	.....
3,011	3,331	859	417	2,008	1,261	1,508	4,509	1,454	.....
2,313	.....	.....	.....	.....	.....	.....	475	167	.....
4,453	.....	.....	.....	.....	.....	.....	239	73	.....
487	.....	.....	.....	.....	.....	.....	100	.....	.....
179,372	42,399	.....	.....	2,819	.....	438	25,194	2,979	.....
86,465	59,558	.....	.....	681	218	393	139,063	17,995	.....
158,901	177,011	50	.....	1,737	.....	716	28,162	4,379	.....
4,142	183	.....	.....	.....	.....	.....	8,630	363	.....
375,048	6,258	.....	.....	1,820	.....	1,302	38,661	8,890	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
311,550	96	.....	.....	.....	.....	.....	50,118	1,827	.....
1,350,047	2,939,703	3,813	21,193	790,262	13,833	114,712	374,372	100,772	1,234
361,770	44,528	97	.....	1,310	.....	4,906	149,836	24,064	491
268,983	96,051	189	.....	113,548	.....	15,138	72,039	26,947	3,524
3,107,063	3,369,118	5,025	21,610	914,185	15,312	139,113	891,570	189,948	5,249

TABLE 7.—SUMMARY OF REVENUE RAILROAD SHIPMENTS FROM ILLINOIS, INDIANA, AND WESTERN KENTUCKY AND WEST BOUND FROM THE APPALACHIAN FIELDS[a] *(Exclusive of Non-revenue Railroad Shipments)*

Market District	Total Shipments			Illinois Shipments			Percent from Illinois		
	1932	1933	1934	1932	1933	1934	1932	1933	1934
Chicago	16,554,379	17,757,618	17,969,135	4,466,098	5,545,390	5,673,467	27.0	31.4	32.1
Illinois, other [b]	10,156,448	9,093,110	9,825,572	6,699,697	6,430,604	7,417,982	61.0	71.3	75.5
Milwaukee, Wis	207,688	249,802	191,196	11,297	11,026	16,455	5.4	4.4	5.6
Wisconsin, other	1,653,632	1,754,181	2,189,888	336,127	425,939	719,061	20.3	24.7	33.0
Council Bluffs, Iowa [c]	122,305	60,111	54,413	94,565	45,241	42,499	77.2	76.0	78.0
Iowa, other	3,431,502	3,142,259	3,107,063	1,743,378	1,555,073	1,661,597	42.9	50.2	53.5
St. Louis, Mo. [d]	3,712,900	3,115,134	3,369,118	2,883,572	2,598,993	2,939,799	77.5	84.9	87.2
Kansas City, Mo. [e]	14,246	5,129	5,025	12,739	4,343	3,813	89.4	84.5	75.7
St. Joseph, Mo. [f]	22,166	15,096	21,610	21,707	14,759	21,193	97.8	92.6	97.9
Missouri, other	1,237,063	982,339	914,185	928,451	814,159	790,262	75.0	83.9	86.4
Kansas, other	23,891	16,519	15,312	21,504	15,202	13,833	89.8	92.0	90.1
Nebraska, other	169,115	128,660	139,113	136,773	103,930	114,712	80.6	81.2	82.4
Minnesota	1,083,426	921,484	891,570	446,122	359,645	424,490	41.1	39.4	47.5
South Dakota	226,996	190,716	189,948	106,589	82,189	102,599	46.8	43.6	53.9
North Dakota	4,097	4,141	5,249	557	672	1,234	13.6	16.8	23.3
Total	38,619,824	37,114,880	38,888,397	17,639,176	18,007,165	19,942,996	45.5	48.4	51.3

[a] Data from U. S. Bureau of Mines, Monthly Coal Distribution Reports.
[b] Includes Davenport, Iowa, for shipments from Ohio and the Crescent; and includes Davenport, Bettendorf, and Iowa, for shipments from the Interior field; excludes East St. Louis.
[c] Includes Omaha, and South Omaha, Nebraska.
[d] Includes East St. Louis, Illinois.
[e] Includes Kansas City, Kansas.
[f] Includes Atchison and Leavenworth, Kansas.

TABLE 8.—BITUMINOUS COAL SHIPMENTS TO LAKE SUPERIOR AND LAKE MICHIGAN PORTS, 1929-1934 [a]

(In thousands of tons)

Year	Superior	Michigan	Total
1934	8,569	10,912	17,481
1933	6,909	10,267	17,176
1932	6,221	7,066	13,287
1931	8,502	9,216	17,718
1930	[b]	12,056	.....
1929	[b]	12,533	.....

[a] U. S. Bureau of Mines, Monthly Coal Distribution Reports.
[b] Not available.

TABLE 9.—RECEIPTS OF BITUMINOUS COAL AT UPPER LAKE DOCKS, 1931-1934 [a]

(In thousands of tons)

Year	Superior	Michigan	Total
1934	8,023	4,534	12,557
1933	6,502	4,565	11,067
1932	5,949	3,663	9,612
1931	7,673	4,454	12,127

[a] All commercial American docks on Lake Superior and west bank of Lake Michigan as far south as Racine and Kenosha; not including Waukegan and Chicago. U. S. Bureau of Mines, Monthly Coal Distribution Reports.

TABLE 10.—LAKE CARGO BITUMINOUS COAL SHIPMENTS TO THE CHICAGO DISTRICT, 1920-1933 [a]

(In thousands of tons)

Year	Port of Chicago	Chicago Harbor	Chicago River	Calumet Harbor and River	Indiana Harbor
1920	687	6	..	681	...
1921	376	..	..	376	725
1922	596	..	..	596	790
1923	1,251	35	..	1,217	1,263
1924	723	69	..	854	1,123
1925	1,472	62	..	1,410	1,280
1926	1,968	15	103	1,850	1,000
1927	1,686	4	24	1,658	1,503
1928	2,785	55	..	2,730	1,644
1929	2,654	67	54	2,533	1,670
1930	2,238	52	37	2,149	1,474
1931	1,584	71	12	1,500	868
1932	1,204	81	17	1,106	515
1933	1,512	64	100	1,348	688

[a] Data from Annual Reports of U. S. Corps of Engineers, War Department.

TABLE 11.—LAKE CARGO ANTHRACITE SHIPMENTS TO THE CHICAGO DISTRICT, 1920-1933 [a]
(In thousands of tons)

Year	Port of Chicago	Chicago Harbor	Chicago River	Calumet Harbor and River
1920	737	508	...	229
1921	556	379	...	187
1922	194	170	...	24
1923	583	378	...	205
1924	505	389	...	116
1925	217	160	...	57
1926	244	...	232	12
1927	88	...	83	6
1928	107	24	76	6
1929	37	...	37	...
1930	56	6	50	...
1931	32	...	32	...
1932	9	...	9	...
1933	12	...	12	...

[a] Data from Annual Reports of U. S. Corps of Engineers, War Department.

TABLE 12.—LAKE CARGO COAL SHIPMENTS TO MILWAUKEE, 1920-1933 [a]
(In thousands of tons)

Year	Bituminous	Anthracite	Coke
1929	3,950	487	...
1930	3,665	445	27
1931	3,070	308	16
1932	2,656	148	44
1933	3,476	161	73

[a] Data from Annual Reports of U. S. Corps of Engineers, War Department.

TABLE 13.—LAKE CARGO COAL SHIPMENTS TO DULUTH-SUPERIOR, 1921-1933 [a]
(In thousands of tons)

Year	Bituminous coal	Anthracite
1921	8,320	1,845
1922	5,139	566
1923	11,268	1,420
1924	7,731	1,290
1925	8,883	790
1926	9,169	1,273
1927	11,452	981
1928	9,688	652
1929	10,330	401
1930	9,342	461
1931	7,357	300
1932	5,651	65
1933	6,179	135

[a] Data from Annual Reports of U. S. Corps of Engineers, War Department.

Coal production in other states within the Illinois market area.—In addition to shipments of coal from the Appalachian, Indiana, and western Kentucky fields by rail and rail-lake hauls, the Illinois coal industry shares the market with local production in states west of Mississippi River. Production in these states, 1930-1934, is as follows:

TABLE 14.—COAL PRODUCTION IN IOWA, KANSAS, MISSOURI, AND THE DAKOTAS
(In thousands of tons)

Producing State	1930	1931	1932	1933	1934
Iowa	3,893	3,388	3,862	3,195	3,345
Kansas	2,430	1,987	1,953	2,218	.....
Missouri	3,853	3,621	4,070	3,432	5,800
North Dakota	1,700	1,519	1,740	1,782	1,770
South Dakota	13	27	49	59	60
Total	11,889	10,542	11,674	10,686	10,975

TABLE 15.—STRIP-MINED COAL IN ILLINOIS, 1929-1934

Year	Output, tons	Percent of total output
1929	5,374,813	8.8
1930	6,116,415	11.3
1931	6,262,501	14.6
1932	6,423,935	20.4
1933	5,423,796	15.4
1934	5,777,202	14.1

Fuel briquets.—Distribution of fuel briquets in 1934 increased over the previous year in the Illinois coal market area and is again nearly equal to sales in 1931.

TABLE 16.—BRIQUETS CONSUMED FOR DOMESTIC FUEL IN THE ILLINOIS COAL MARKET AREA, 1931-1934 [a]
(In net tons)

State	1931	1932	1933	1934
Illinois	7,918	5,474	6,218	12,606
Wisconsin	77,907	65,872	89,131	104,885
Minnesota	200,583	137,292	133,102	168,067
Iowa	23,843	18,310	19,269	22,713
Missouri	4,271	3,005	4,360	5,904
North Dakota	52,288	43,915	46,746	50,525
South Dakota	39,490	29,999	28,704	34,401
Nebraska	16,975	8,245	8,992	16,171
Kansas	10,033	6,262	4,243	5,278
Total	433,308	318,374	340,765	420,550
Total for the United States	688,258	485,288	529,162	703,592

There are nine briquetting plants in operation in the Illinois coal market area with the following locations, dates on which these plants were put in operation, and the raw materials used.

TABLE 17.—BRIQUETTING PLANTS IN THE ILLINOIS COAL MARKET AREA

State	Location	Date plant was put in operation	Raw materials used
Minnesota	Duluth	1933	Anthracite & bituminous slack
Missouri	Kansas City	1909	Semi-anthracite
Nebraska	Omaha	1933	Anthracite & bituminous slack
North Dakota	Lehigh	1929	Lignite char
Wisconsin	Superior	1912	Bituminous slack
Wisconsin	Ashland	1931	Bituminous slack
Wisconsin	Superior	1909	Anthracite & bituminous slack
Wisconsin	Milwaukee	1928	Bituminous slack
Wisconsin	Sheboygan	1933	Bituminous slack

[a] U. S. Bureau of Mines, Weekly Coal Report No. 926, April 13, 1935.

The Illinois coal market area uses about 60 per cent of the briquets made in the United States. This is mainly the result of an attempt to use the slack coal produced in the handling of coal over the lake docks or, in the case of North Dakota, to utilize lignite. As a consequence the heaviest sales of briquets are near the sources of supply—Minnesota, Wisconsin, and North Dakota. In Illinois and Missouri where no plants are as yet located, the sale of briquets is extremely low. Development of a market for briquets will be somewhat more

difficult in these states in view of the fact that bituminous coal for domestic purposes is sold at a lower price than in the states tributary to the lake docks territory. Prices of fuel briquets in the Central States is shown in Table 18 below.

TABLE 18.—AVERAGE VALUE PER NET TON *(f. o. b plant)* OF BRIQUETS PRODUCED IN THE CENTRAL STATES, 1923-1934

Year	Value	Year	Value	Year	Value
1923	$9.35	1927	$8.30	1931	$8.11
1924	9.00	1928	8.38	1932	7.60
1925	8.72	1929	8.13	1933	6.71
1926	8.86	1930	8.13	1934	6.54

Trend in natural gas consumption.—Importation of natural gas into the Illinois coal market area continued its upward trend in 1934 over previous years although the rate of growth is declining. Detailed data on natural gas distribution and consumption is not yet available. Natural gas consumption was extended into Minnesota in 1934 but beyond that no other significant extensions were made.

TABLE 19.—NATURAL GAS IMPORTED INTO THE ILLINOIS COAL MARKET AREA[a]
(In millions of cubic feet)

From	1928	1929	1930	1931	1932	1933	1934
To Illinois							
Kansas				26	719	974	2,019
Louisiana		156	6,712	7,553	8,330	10,704	10,971
Missouri				175	223	178	164
Texas				4,166	18,348	19,766	29,952
Kentucky					49	67	111
Indiana					6	24	3
Total		156	6,712	11,920	27,675	31,713	43,220
To Missouri							
Kansas	9,406	14,635	20,284	3,033	3,771	3,731	4,716
Louisiana		133	5,464	5,406	7,673	8,279	9,274
Oklahoma				5,447	3,607	2,516	2,880
Texas				9,217	9,822	12,638	12,597
Total	9,406	14,768	25,748	23,103	24,873	27,164	29,467
To Iowa							
Kansas			8	1,795	4,641	6,526	5,617
Texas				1,727	2,892	4,882	11,019
Total			8	3,522	7,523	11,408	16,636
To Nebraska							
Kansas			1,098	2,802	5,340	6,215	6,323
Oklahoma				31	39	89	181
Texas				1,837	2,677	3,235	5,473
Wyoming				147	605	754	812
Total			1,098	5,817	8,661	10,293	12,789
Grand total	9,406	14,924	33,666	43,362	68,732	80,578	102,112

[a] Annual Mineral Resources of the United States, U. S. Bureau of Mines.

TABLE 20.—CONSUMPTION OF NATURAL GAS IN THE ILLINOIS COAL MARKET AREA, 1929-1932
(In millions of cubic feet)

	Illinois	Iowa	Missouri	South Dakota	Nebraska
1929					
Domestic	94	.....	7,224	8,700	.....
Field	2,895	.....	12	.....	.....
Petroleum refineries	.....	.....	.....	.....	.....
Electric utility plants	.....	.....	456	.....	.....
Industrial	150	.....	7,386	847	.....
Total	3,139	.....	15,078	1,717	.....
1930					
Domestic and commercial	115	.....	9,158	1,172	180
Field	2,806	.....	3	.....	.....
Petroleum refineries	149	.....	2,422	.....	.....
Electric utility plants	.....	.....	966	.....	263
Industrial	6,532	.....	13,573	1,733	655
Total	9,602	.....	26,122	2,905	1,098
1931					
Domestic and commercial	3,631	471	9,734	1,142	1,163
Field	2,038	.....	7	.....	.....
Petroleum refineries	11	.....	1,106	.....	.....
Electric utility plants	.....	358	1,106	.....	1,084
Industrial	8,370	2,693	12,308	1,661	2,570
Total	14,050	3,522	24,261	2,803	4,817
1932					
Domestic and commercial	16,113	1,328	11,684	1,350	2,605
Field	1,722	.....	3	.....	.....
Petroleum refineries	136	.....	18	.....	.....
Electric utility plants	.....	1,314	1,867	62	1,726
Industrial	11,461	4,891	11,738	1,364	4,330
Total	29,432	7,533	25,310	2,776	8,661
1933					
Domestic and commercial	17,272	2,199	11,938	1,361	3,107
Field	1,573	.....	18	.....	.....
Petroleum refineries	179	.....	.....	.....	.....
Electric utility plants	.....	2,259	2,218	128	1,701
Industrial	14,353	6,950	13,405	1,775	5,485
Total	33,377	11,408	27,579	3,264	10,293
1934					
Domestic and commercial	19,628	3,501	12,109	1,505	3,459
Field	1,435	.....	12	.....	.....
Petroleum refineries	646	.....	3	.....	.....
Electric utility plants	358	3,249	2,668	473	2,262
Industrial	23,017	9,886	15,000	1,923	7,068
Total	45,084	16,636	29,792	3,901	12,789

PETROLEUM

Production and price.—The production of crude petroleum in Illinois in 1933 and 1934, by months, is given in Table 21.

TABLE 21.—PETROLEUM PRODUCTION IN ILLINOIS, 1933-1934

Month	1933	1934	Month	1933	1934
January	297,000	393,000	July	404,000	394,000
February	263,000	337,000	August	411,000	402,000
March	314,000	394,000	September	412,000	378,000
April	284,000	373,000	October	406,000	352,000
May	313,000	411,000	November	388,000	305,000
June	357,000	392,000	December	378,000	321,000
First 6 months	1,828,000	2,300,000	Year	4,227,000	4,452,000

The average price of Illinois petroleum in 1934 was $1.13 as compared with $0.87 in 1933 and $1.03 in 1932.

The quotas of allowable production for Illinois during 1934, as authorized by the Federal Oil Administrator, were as follows:

	Bbls. per day
January to March, inclusive	12,000
April, May	12,500
June, July	12,600
August	12,500
September to November, inclusive	12,000
December	11,700

In addition to the restrictions imposed by the Federal Oil Administrator, a restriction of 25 per cent below the Federal allowable was imposed on October 11th and continued until December 15th, when curtailment was reduced to 18 per cent. On December 18th, it was further reduced to 15 per cent.

Statistical summary.—In Table 22 are given the data on petroleum refining and consumption as far as the information is available.

TABLE 22.—STATISTICAL SUMMARY OF THE INDUSTRY

	1933	1934
Production	4,227,000	4,452,000
Daily Average	11,581	12,197
Receipts from other States	29,466,000	[a]
Runs to stills	33,386,000	[a]
Delivery to other States	341,000	[a]
Exports	653,000	[a]
Production of gasoline	17,623,000	
Consumption of gasoline	23,119,000	
Refinery capacity (daily)	128,050	

[a] Not available.

The petroleum industry in 1934.—The outstanding feature of the petroleum industry in 1934 has been a growing conviction that easily obtainable production from flush pools is not unlimited and inexhaustible and that a careful inventory of reserves from all sources and their most effective and complete recovery is essential if adequate annual flow of oil is to be maintained.

The discovery of new pools in each of the oil production states shows a gradual approach to a maximum followed by a decline and ultimate cessation. In Ohio, for example, the first pool was discovered in 1859. Progress was slow until 1895 when 8 pools were discovered, and until 1905, with two exceptions, several pools were discovered each year. Since 1905 only three pools have been discovered in Ohio, the last one in 1924. In Pennsylvania, the record of discovery is larger than Ohio and covers a longer period but no discoveries have been made since 1926. In Indiana the latest discovery occurred in 1928 and in West Virginia in 1930. New discoveries are always possible but the rate of discovery is diminishing.

With respect to new and proved reserves added each year to the nation's visible supply of oil, the situation is also critical in spite of the current abundant supply.

Important oil field discoveries have been relatively scarce during the past four years and new reserves are slower in yielding to the industry's test wells. Meanwhile, the existing flush fields have been gradually but appreciably dissipating their productive ability. In this connection it may be of interest to examine a table on the production and discovery experience of the American oil-producing industry by periods, as shown in Table 23.

TABLE 23.—ANALYSIS OF PRODUCTION AND DISCOVERY EXPERIENCE OF THE AMERICAN OIL-PRODUCING INDUSTRY BY PERIODS [a]

(1)	(2)	(3)	(4)	(5)	(6)
1859–1900	25	80	0.3	0.3	0.003
1901–1905	105	340	0.3	0.3	0.01
1906–1910	175	275	0.4	0.6	0.01
1911–1915	250	500	0.4	0.5	0.02
1916–1920	370	585	0.5	0.6	0.02
1921–1925	650	820	0.6	0.8	0.03
1926–1930	895	1,990	0.5	0.4	0.07
1931–1934	870	580	0.6	1.5	0.02

Column No. 1—periods analyzed.
2—average annual production in millions of barrels.
3—average annual discoveries in millions of barrels.
4—ratio of accumulated production to accumulated discoveries.
5—ratio of average annual production to average annual discoveries.
6—ratio of average annual discoveries to total discoveries for all periods.

[a] Prepared by Wallace E. Pratt, Vice-President of the Humble Oil and Refining Company, Oil and Gas Journal, May 2, 1935.

Of particular significance are the data presented in columns (4) and (5) of this table. Consumption has been gradually gaining upon new discoveries until it has risen from 0.3 of total discoveries to 0.6. As shown in column (4) and in the period 1931-1934, current production has exceeded current discoveries by 50 per cent. Only through the discovery of several large pools in the previous five-year period has it been possible to provide an ample supply of motor fuel to the consuming public since 1931. In the meantime, the rate of drilling during the depression years has fallen off less than the rate of new discoveries and in 1934 and 1935 again showed a substantial increase.

The proved oil reserves now in sight, according to a report to a subcommittee of the Committee on Interstate and Foreign Commerce of the House of Representatives, are placed at 13,360,000,000 barrels, as is shown in Table 24 taken from this report.

TABLE 24.—ESTIMATED OIL RESERVES OF THE UNITED STATES[a]

State	Total production of oil to Dec. 31, 1933. Barrels	Total estimated oil reserves as of Dec. 31, 1933. Barrels
Arkansas	396,801,000	29,500,000
California	4,036,663,000	5,422,500,000
Colorado	29,500,000	8,500,000
Illinois	412,263,000	34,000,000
Indiana	120,145,000	5,000,000
Kansas	703,624,000	194,000,000
Kentucky	129,296,000	30,000,000
Louisiana	512,937,000	136,000,000
Michigan	28,211,000	17,000,000
Montana	45,979,000	57,000,000
New Mexico	58,810,000	92,500,000
New York	85,454,000	45,000,000
Ohio	563,041,000	34,000,000
Oklahoma	3,514,263,000	844,500,000
Pennsylvania	878,360,000	252,500,000
Texas	3,415,309,000	5,884,000,000
West Virginia	384,373,000	27,500,000
Wyoming	374,732,000	245,000,000
Others	618,000	1,500,000
Total	15,690,379,000	13,360,000,000

[a] Hearings before a subcommittee of the Committee on Interstate and Foreign Commerce, House of Representatives, 73rd Cong., H. Res. 441, Part 2, p. 1081.

The estimate of reserves given above is based upon existing methods of production. The recoverable oil represents a part, estimated at from 25 to 35 per cent of the oil in the reservoir. It does not consider the reserve that can be recovered by improved methods of production or the oil obtainable under a higher price level for crude. This estimated reserve of oil, if withdrawn at the

rate of 900,000,000 barrels annually, would last about 15 years provided no new fields were found in that time or methods of augmenting the supply from existing pools are devised. Practically, it will be impossible to produce the full amount of the estimated reserves in even 25 years. As a field approaches the end of its productivity the rate at which oil can be taken out gradually declines. The effect of this has been, in the absence of major pool discoveries since 1930, to increase the relative importance of stripper well areas as ultimate sources of supply.

The existing curtailment of production has been necessary primarily because of the danger of unmanageable surplusses from East Texas and other prolific pools. But the present potential output in excess of current demand conceals a situation of impending shortage unless steps are taken to increase the rate of discovery or increase recovery from existing fields.

The position of the stripper well.—In view of the need of searching now for the means of supplying the oil needed in 1940, it is obviously unwise to seek new and untried sources such as alcohol, oil shale, or motor fuel from coal, and at the same time impose hampering restrictions upon existing sources of potential motor fuel supply. The importance of the stripper well cannot be judged entirely from its annual contribution to crude oil production, though that may appear to be small. For example, the petroleum output of the states[1] with wells averaging less than 1.1 barrel per day was, in 1934, 37 million barrels. This, however, does not indicate the total production from stripper wells since there are large numbers of these wells in the large oil producing states whose average production per well per day is substantially above one barrel, and in the Gulf Coast of Louisiana, reaches 108 barrels per day. In these states the number of stripper wells is concealed in the high output of a few flush wells.

The second factor that must be considered in evaluating the importance of the stripper well is the duration of production from stripper wells as compared with the spectacular pools of high initial production and prolific flow for a limited period. Although the output per well per day in Illinois, at a maximum, was about 9.7 barrels per well per day and that only for a short period; nevertheless, the total yield of the southeastern Illinois field is exceeded only by four other fields in the United States.[2]

Finally, the decreasing rate at which flush pools are being discovered and brought into production is gradually bringing about a lower percentage of the annual supply from this type of pool and increasing the proportional supply from the smaller wells. With each succeeding week, as the production of new wells is reported, the absence of any major discoveries serves to increase the nation's dependence upon small producers.

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[1] Illinois, Pennsylvania, Ohio, Kentucky, West Virginia, New York, Indiana and Tennessee.

[2] (1) Sunset-Midway, California; (2) East Texas; (3) Seminole, Oklahoma; (4) Long Beach, California.

If, in the light of current conditions of demand and new discovery, the producers of petroleum are expected to make their utmost contribution to the future oil supply of the United States, a practical policy of conservation of these pools must be planned and carried out. If, in the interests of a continued oil supply, in which the oil industry is just as vitally interested as is the consumer, it becomes necessary, temporarily, to curtail production in order to reduce the current unmanageable surplusses and prevent new ones from appearing, it is not unreasonable to restrain the flow of new oil as long as the existing production faculties can meet current demand. Specifically, the control of oil in the East Texas field will do much to restore the demand-supply balance and will ultimately react to the benefit of the several owners and producers in this field.

With regard to wells in the stripper class, the soundest program of conservation and greater ultimate recovery is the removal of all restrictions. The hope of greater ultimate recovery in the stripper well districts, whether they be located in Illinois, Pennsylvania, Kansas or elsewhere, lies in increasing the flow by improved recovery methods. But there can be no incentive for investment in improved recovery methods unless two conditions are met: (1) investment in these methods must reduce the per barrel lifting costs, or conversely, must yield an additional quantity of oil which is greater in value than these added investment costs; (2) the benefits of increased recovery must not be nullified by artificially imposed restrictions. In addition to the normal handicaps of higher production costs, the stripper wells have just passed through a period of unusually severe price drops occasioned by the sudden appearance of several large fields and intensified by the general fall in price levels since 1929. That this situation cannot endure indefinitely is obvious. The continuance of the small well and the hope of increased recovery from the small well is contingent primarily upon the removal of all production restrictions upon the operators. The necessity of this is evident from a comparison of operating and total costs in certain selected fields.

TABLE 25.—COSTS OF OIL PRODUCTION, EXCLUSIVE OF INTEREST CHARGES, 1931-1933 [a]

State	Depletion	Depreciation	Amortization	Operating Costs	Overhead Costs	Total
Illinois	.06	.23	.02	.70	.24	1.25
Texas	.06	.09	.04	.14	.28	.61
Kansas	.09	.22	.07	.24	.33	.95
Pennsylvania	.25	.34	.22	.58	.19	1.58
East Texas	.032	.063	.050	.082	.267	.494
Oklahoma City	.076	.119	.121	.123	.283	.722

[a] United States Department of the Interior, Petroleum Administrative Board, "Preliminary Report on a Survey of Crude Petroleum," Cost of Production for the Years 1931-1933 and Comparison with Years 1927-1930, p. 8.

The practical value of improved methods of recovery has been demonstrated in Pennsylvania where no new pools of significant size have been discovered since 1920. Experiments in Pennsylvania with flooding the oil sands as well as repressuring with gas and air began in 1921 but did not begin to show appreciable results until 1925, and as a result of the application of improved methods of recovering oil, the production rose from 7,438,000 barrels in 1920 to 14,666,000 in 1934.

The low production costs for a particular pool at a time of flush production are below the average cost of production over the entire life of the pool but these low costs affect for the time being the entire price structure.

Now if the country could be assured of the discovery and opening up of flush pools in rapid succession and properly timed, for an indefinite future, then this type of production could be looked upon as normal, the need for improved production practices, such as have been discussed here would disappear, and the stripper well would go permanently into the submarginal class. But the assumption of a continuing occurrence of flush pools cannot be justified. To frame an oil policy on this basis, which would mean the extinction of the stripper well, would result in periods of underproduction with high prices to the consumer, and a dislocation of the price structure in the oil industry which would be just as bad in one direction as ruinously low prices are in the other direction.

The alternative is to consider the small wells of the country as a back-log of assured production during the intervals between flush pool production. As such, an economic policy must be framed which will protect the life of these wells. As such, the basis of their continuance must not be measured by the price of distress oil from flush pools that is thrown upon the market utterly regardless of the existing conditions of demand, but must be measured on a basis of overall costs of production that are necessary to keep the country adequately supplied with oil from both big and small wells. This may look like a subsidy for the small wells, but it is doubtful in fact, if such is the case. For example, if, by the iron law of uncontrolled competition, the flush pools were allowed temporarily to govern the price, and the small wells suffered extinction, then with the first lull in flush production output, the prices would rise and also expenditures to revive production in abandoned fields or to find oil in hitherto unexplored fields. These total expenditures may quite likely exceed the expenditure of supporting the small wells through flush and lean periods.

CLAY PRODUCTS

The value of clay products in 1934 was $5,945,199.60, of which structural clay products represented $4,498,959.73 and pottery was valued at $1,446,239.27. Compared with previous years there was a slight increase in total value but a decline in the value of pottery products (Table 26).

TABLE 26.—VALUE OF CLAY PRODUCTS, 1932 TO 1934

	1932	1933	1934
Structural and refractory clay products	$2,504,610	$2,328,556	$4,498,960
Pottery	1,837,033	1,816,467	1,446,239
Total	$4,341,643	$4,145,033	$5,945,199

Production of clay products, by types, in 1934 is given in Table 27.

TABLE 27.—PRODUCTION OF CLAY PRODUCTS, BY CLASSES, 1934

	Quantity	Value	Stocks on hand
Common brick (M)	64,073	$ 590,690.66	58,963
Face brick (M)	24,667	365,978.09	20,057
Hollow Building Tile (tons)	45,844	169,660.70	65,785
Drain Tile (tons)	17,597	128,962.56	16,689
Vitrified Brick or Block (M)	18,353	327,705.82	656,940
Refractory Clay Products		2,372,555.80	
Other Clay Products		543,406.10	
Pottery		1,446,239.87	
Total		$5,945,199.60	

TABLE 28.—PRODUCTION OF COMMON BRICK, BY PRINCIPAL DISTRICTS, IN 1934

District	1934 Quantity thousands	1934 Value	Stocks on hand Dec. 31st (thousands)		
			1934	1933	1932
Chicago (Lake, Cook and Will counties)	35,649	$307,677.50	37,984	43,910	64,535
Northern Illinois (Bureau, Fulton, Knox, LaSalle, Livingston and Tazewell counties)	18,258	173,198.15	12,033	5,206	7,856
Central and Western Illinois (Henry, Macon, Menard and Sangamon counties)	2,935	29,736.17	4,572	(a)	2,778
East St. Louis district	4,948	53,635.84	2,635	1,827	2,799
Other	2,283	26,443.00	1,740	4,183	3,795
Total	64,073	$590,690.66	58,964	55,126	81,763

Production of common brick and stocks on hand in principal market districts of the State are shown in Table 28.

Stocks of structural clay products in the hands of producers continued to decline in 1934 as shown in Tables 29 to 31. In the three leading products—

TABLE 29.—SHIPMENTS OF COMMON BRICK IN ILLINOIS IN 1932 TO 1933 [a]

	Number of plants	Shipments		Thousands stocks on hand at end of month
		Thousands	Value	
1932				
January	39	4,307	$35,469	108,780
February	37	4,215	33,219	104,854
March	38	3,591	34,691	98,384
April	36	6,165	51,235	96,036
May	33	6,558	52,546	89,841
June	33	5,316	40,947	86,715
July	34	5,488	43,172	86,016
August	32	5,430	40,669	81,203
September	33	4,848	36,675	80,839
October	30	4,791	35,899	74,568
November	32	3,485	25,862	69,014
December	30	2,194	16,522	69,771
1933				
January	30	1,787	13,795	68,236
February	31	1,357	10,775	67,196
March	32	1,975	15,695	66,275
April	33	3,072	24,885	70,180
May	33	4,138	32,253	62,771
June	34	4,774	37,497	64,197
July	34	5,888	47,280	65,574
August	34	5,810	45,889	66,620
September	34	5,843	44,983	61,883
October	34	7,423	58,430	56,228
November	34	5,083	41,183	56,993
December	34	3,861	31,148	58,993
1934				
January	33	4,818	38,712	56,284
February	35	2,669	22,876	53,674
March	35	4,579	37,861	49,986
April	32	3,826	35,174	47,762
May	32	5,303	45,332	51,010
June	32	6,267	58,180	53,259
July	32	5,640	54,070	50,899
August	32	6,210	57,158	46,587
September	31	6,569	61,958	43,960
October	31	8,650	79,490	43,217
November	31	5,069	49,061	49,731
December	32	2,669	24,292	55,120

[a] Data from Monthly Report on "Structural Clay Products," U. S. Bureau of Census.

common brick, face brick, and hollow building tile—there were from ten to twelve months supply of stocks on hand on December 31st, based on the average monthly shipments for the current year.

TABLE 30.—SHIPMENTS OF FACE BRICK IN ILLINOIS IN 1932 TO 1934 [a]

	Number of plants	Shipments		Thousands stocks on hand at end of month
		Thousands	Value	
1932				
January	22	2,182	$30,945	51,867
February	20	2,212	32,227	47,851
March	22	2,443	35,186	53,654
April	19	3,918	62,071	48,801
May	18	3,479	53,447	42,702
June	18	3,615	53,168	41,502
July	19	2,978	41,695	42,726
August	18	3,124	43,604	39,657
September	18	3,182	42,222	41,039
October	15	2,950	40,502	36,827
November	17	1,622	20,297	36,863
December	18	734	9,034	46,668
1933				
January	18	932	11,718	46,811
February	18	605	7,778	45,700
March	19	1,212	16,581	46,166
April	19	1,576	20,937	45,245
May	19	2,117	28,901	43,777
June	20	2,826	34,898	41,866
July	20	2,913	39,382	32,972
August	21	3,152	42,175	31,844
September	21	2,367	31,148	31,607
October	20	2,167	30,633	29,735
November	20	1,690	23,184	29,148
December	20	1,268	17,833	26,863
1934				
January	20	1,071	14,620	25,387
February	19	810	11,751	24,891
March	19	1,350	19,663	23,612
April	17	1,529	23,331	26,730
May	17	2,608	42,920	27,057
June	17	2,791	46,751	26,675
July	17	2,958	51,044	25,322
August	17	2,931	52,033	24,768
September	17	2,768	47,793	23,229
October	17	2,983	50,865	23,421
November	17	1,931	33,154	23,103
December	17	927	15,617	23,281

[a] Data from Monthly Report on "Structural Clay Products," U. S. Bureau of Census.

TABLE 31.—SHIPMENTS OF HOLLOW BUILDING TILE IN ILLINOIS IN 1932 TO 1934 [a]

	Number of plants	Shipments		Thousands stocks on hand at end of month
		Thousands	Value	
1932				
January	19	3,484	$14,755	74,478
February	17	2,879	10,498	71,602
March	17	2,521	8,734	70,179
April	15	3,578	11,980	67,985
May	15	3,562	12,332	66,268
June	15	2,765	8,179	68,172
July	16	3,933	10,865	63,352
August	15	2,479	7,383	54,913
September	15	2,978	9,375	52,055
October	14	1,517	5,964	45,884
November	14	735	2,945	45,612
December	16	499	1,912	45,282
1933				
January	15	2,269	6,554	47,880
February	16	538	1,862	47,331
March	15	525	1,944	47,125
April	15	927	3,676	46,216
May	16	1,147	4,921	45,176
June	17	1,142	4,690	45,565
July	17	1,124	5,549	46,004
August	16	1,611	7,001	45,834
September	17	3,132	10,853	42,922
October	17	1,940	8,249	41,790
November	17	1,177	5,284	40,406
December	17	1,053	5,032	39,519
1934				
January	17	2,477	6,044	37,617
February	17	2,031	9,370	36,853
March	17	3,419	20,135	36,251
April	17	3,621	18,693	34,587
May	17	2,399	11,185	35,083
June	17	1,845	10,417	33,824
July	17	2,339	12,947	32,976
August	17	3,755	20,086	31,067
September	16	3,100	16,901	29,188
October	16	2,808	15,363	28,093
November	16	2,497	14,525	29,927
December	15	1,289	7,646	34,766

[a] Data from Monthly Report on "Structural Clay Products," U. S. Bureau of Census.

GLASS SAND

Economic possibilities of glass sand utilization in Illinois.—The unusually large supply of excellent glass sand in Illinois[1] raises the question of the economic possibilities of a more extensive manufacture of glass products in this state. At the present time Illinois exports substantial quantities of sand for glass making purposes while also importing glass products from distant sources. Although Illinois ranks first in glass sand output, it is fifth in value of manufacture of glass products. Glass manufacture began on the Atlantic Seaboard and moved westward with the movement of population, aided by the opportune discovery of natural gas fields in the Appalachian and Ohio Valley states. As long as glass making was done by hand, the abandonment of established factories in favor of new establishments near cheap fuel supplies and growing markets involved no great loss of capital investment and the migration of glass plants was rapid. With the introduction of expensive machinery, notably the Owens bottle making machine in 1895, with its high capital costs, glass establishments became more immobile, and there was a greater lag between the westward movement of markets and the migration of the glass industry. However, the location of industrial enterprises is constantly changing in favor of more economical relations between raw materials and markets, and the enlargement of glass making facilities in the midst of the large glass markets of the Upper Mississippi Valley will ultimately be brought about.

The logical step in evaluating the possibilities of an enlarged glass making industry in Illinois is to analyze the market conditions and point out the most favorable existing opportunities for the utilization of the available resources in the State.

Distribution of glass manufacture in the United States.—Seven states are important in the glass industry of the United States in the order named: Pennsylvania, West Virginia, Ohio, Indiana, Illinois, New York, and New Jersey. These states produce approximately 85 per cent of the value of glass goods. Other states with a significant industry are California, Missouri, Oklahoma, and Kansas. Table 32 gives the value of glass output, by percentages, in the seven leading states for specified years covering the period from 1909 to 1931. An examination of this table shows that the most significant increases have occurred in West Virginia and Illinois, both states with a surplus of glass sand, while those states which imported glass sand were practically stationary or showed declines in value of glass products.

[1] Lamar, J. E., Geology and Economic Resources of the St. Peter Sandstone of Illinois: Illinois State Geol. Survey Bull. 53, 1927.

TABLE 32.—VALUE OF GLASS OUTPUT, IN PERCENTAGES, BY STATES FOR SPECIFIED YEARS

Year	Illinois	Indiana	New York	Ohio	Penna.	W. Va.	N. Jer.	Other
1931.....	9.0	13.0	5.4	17.9	23.2	15.0	5.4	13.1
1929.....	7.5	11.4	5.9	13.0	26.8	15.9	5.4	14.1
1927.....	7.6	12.5	5.7	12.0	27.8	15.6	5.5	14.1
1925.....	5.6	12.2	5.9	11.9	28.8	16.2	5.4	14.0
1923.....	5.4	13.2	5.0	11.1	32.0	16.2	5.0	12.1
1921.....	6.8	10.1	6.3	11.9	30.8	16.2	6.1	11.8
1919.....	6.9	13.5	5.0	13.5	30.9	16.3	5.2	8.7
1914.....	6.2	12.1	4.2	15.5	32.2	11.9	6.2	11.7
1909.....	5.5	12.5	4.4	15.6	35.6	8.4	7.6	9.9

The glass market.—The usefulness of glass in industry, in construction, and in household utensils is due to its properties of transparency, resistance to corrosion, and the ease with which it can be formed into sheets, tubes, rods, containers, decorative items, etc. Glass products fall into two general market groups, namely, those products which are manufactured directly for consumer use, and those glass products which enter into the construction of or form a part of a larger article of trade. The former group includes such items as tableware, fruit jars, lamp chimneys and globes, milk bottles, etc. The latter group is comprised of such items as building glass, beverage containers, lamp bulbs, chemical and pharmaceutical glassware. Market characteristics differ for each group and vary within the groups themselves. The market for that group of glass products which is sold directly to consumers will be governed by such items as distribution of population, variations in the purchasing power of population in different geographic areas, effect of style changes, and changes brought about by reason of fluctuations in purchasing power from one period to another. These same items also govern more or less the purchase of glass materials which are used by manufacturers in the fabrication of other consumer goods (for example, plate glass in an automobile) with this important difference: The immediate marketing point for glass products used in the further manufacture of goods is determined by the location of the fabricating plant or plants. Thus the market for approximately 50 per cent of the plate glass output is determined by the location of automobile factories, or another example, the market for lamp bulbs is determined by the location of electric lamp manufacturers. Again, the marketing point for certain types of glass goods is determined primarily by the location of factories using glass products in their operation, and in a secondary manner, by population distribution, as for example, bottles used in the beverage industry, where the industry itself is governed more of less by population distribution.

The market for certain types of glass products may, in some instances, be restricted to a very small number or even one producer when the product requires a high degree of skill or specialization or where one manufacturer is able to dominate the field to the exclusion of possible competitors. The complexities of

market factors must be analyzed in an attempt to evaluate the feasibility of a new or enlarged glass manufacturing industry in a given locality.

Criteria for analyzing distribution of the glass market.—Since glass products are of many kinds and serve diverse uses in the home, in building construction, and in industry, an analysis of the distribution of glass products must take into account such elements as the distribution of population, rate of growth of population, movements of population to or from urban areas, building activities by regions or cities, location of industrial users of glass, changing demands for different types of glass products, etc.

Population.—Population of the United States, as of April 1, 1930, was 122,775,046 or an increase of 16.1 per cent during the preceding decade (1920—105,710,620). In the states which principally comprise the Illinois industrial market area the rate of increase during this same decade was 10.2 per cent, distributed among the individual states as follows:

TABLE 33.—POPULATION IN STATES COMPRISING THE ILLIOIS INDUSTRIAL MARKET AREA, 1920 AND 1930

State	1930	1920	Per cent Increase
Illinois	7,630,654	7,145,374	17.7
Wisconsin	2,939,006	2,632,067	11.7
Minnesota	2,563,953	2,387,125	7.4
Iowa	2,470,939	2,404,021	2.8
Missouri	3,629,367	3,404,055	6.6
North Dakota	680,845	646,872	5.3
South Dakota	692,849	636,547	8.8
Nebraska	1,377,963	1,296,372	6.3
Kansas	1,880,999	1,769,257	6.3
Total	23,866,575	21,661,596	10.2
Average	7,103,595	6,753,069	5.2

Table 33 presents an interesting comparison of population increases in agricultural vs. industrial states. If the dominantly agricultural states (Iowa, North Dakota, South Dakota, Nebraska, and Kansas) are segregated and the poulation increase calculated, it is found to be 5.2 per cent, which is less than one-third the increase for the State of Illinois. A further refinement of the data which would exclude the industrial population of such cities as Omaha, Sioux Falls, Kansas City, Wichita, and the population of oil and coal producing fields in these states would no doubt reduce the percentage of rural increase still further and merely emphasize a condition of agricultural maturity in this belt. This disparity in rates of population increase with the clearly indicated lack of demand for additional agricultural workers emphasizes the need of directing the energies of our population into different channels of productive activity.

Market trends.—The purpose of this inquiry is to ascertain as far as possible the trend of the glass market, the geographical distribution of glass consumption, and the relation of productive facilities to this distribution of consumption. In general the glass market is governed primarily by population distribution, qualified somewhat by variations in purchasing power in different localities, and also, by the demand of glass products used by manufacturing industries rather than ultimate consumers.

The market for glass products showed a consistent upward growth until 1923 after which the trend of output fluctuated more or less with the variation in industrial activity. The trend of production by quantities and values from 1904 to 1933 is shown in Tables 34 and 35. The recession in practically all items of manufacture in 1931 naturally was to be expected in the light of recent industrial conditions. A revival of plate and sheet glass, however, should occur with renewed building activity and automobile manufacture. The market for glass containers such as milk bottles, beverage containers, fruit jars, and for such industrial glass goods as electric lamp bulbs, will probably show less significant increases. The outlook for new products out of glass is problematical at present although articles such as glass bricks and new types of tableware are being offered. The most important immediate outlet is probably in the sheet and plate glass markets.

The importance of the Mississippi Valley as a market for glass products is indicated by a market survey of common window glass made by the U. S. Tariff Commission in 1929. The relative importance of this area compared with the entire country is shown in Table 36.

TABLE 34.—VALUE OF GLASS PRODUCTS BY SPECIFIED YEARS, 1899-1931 [a]
(In thousands of dollars)

Product	1899	1904	1909	1914	1919	1921	1923	1925	1927	1929	1931
Polished plate glass	.....	$ 7,978	$12,205	$14,733	$33,348	$37,261	$66,103	$57,207	$44,258	$50,192	$26,111
Window glass	$10,879	11,611	11,743	17,495	41,101	24,026	42,623	37,525	26,814	25,962	10,397
Obscured glass	732	972	1,359	2,417	4,300	2,547	5,114	6,916	5,092	5,256	2,364
Wire glass—rough	.....	.....	.....	1 057	2,271	2,108	3,882	3,546	2,746	4,278	1,250
—polished	.....	.....	.....	534	635	1,208	1,652	2,264	1,631	1,714	550
Pressed and Blown glass (total)	17,076	21,956	27,398	30,279	70,748	55,718	77,279	72,086	76,657	85,549	56,291
Tableware and ovenware	.....	.....	.....	.....	.....	.....	.....	12,230	13,141	17,264	13,404
Pressed tumblers and goblets	.....	.....	.....	.....	.....	.....	.....	8,679	7,774	14,780	2,844
Blown tumblers, etc	.....	.....	.....	.....	.....	.....	.....	7,100	8,702	.....	7,844
Lenses—motor vehicle	.....	.....	.....	.....	.....	.....	.....	2,743	1,579	2.033	884
—other	.....	.....	.....	.....	.....	.....	.....	.....	.....	933	478
Lamps	.....	.....	.....	.....	.....	.....	.....	427	458	571	542
Lamp chimneys	.....	.....	.....	.....	.....	.....	.....	2,658	2,281	1,951	1.100
Lantern globes	.....	.....	.....	.....	.....	.....	.....	867	636	671	382
Shades, globes, except electric light	.....	.....	.....	.....	.....	.....	.....	10,315	8,154	9,977	6.591
Tubing	.....	.....	.....	.....	.....	.....	.....	3,935	4,023	4,750	3,140
Bulbs for electric lights	.....	.....	.....	.....	.....	.....	.....	23,132	29,909	32,619	19,082
Glass containers (total)	21,677	33,631	36,018	51,959	94,670	85,743	107,231	100,301	114,380	121,655	103,732
Milk bottles	.....	.....	.....	.....	.....	.....	.....	10,588	11,480	11,696	9,725
Narrow neck blown bottles	.....	.....	.....	.....	.....	.....	.....	.....	11,665	10,209	8,843
Wide-mouth blown bottles	.....	.....	.....	.....	.....	.....	.....	.....	19,963	22,946	17,456
Pressed ware	.....	.....	.....	.....	.....	.....	.....	.....	2,447	2,593	1.862
Fruit jars (home pack)	.....	.....	.....	.....	.....	.....	.....	6,641	11,358	8,525	15,103
Beverage containers—pressure ware	.....	.....	.....	.....	.....	.....	.....	.....	15,995	16,690	12,848
—nonpressure ware	.....	.....	.....	.....	.....	.....	.....	.....	1,724	1,776	2,563
Medicinal, toilet, etc	.....	.....	.....	.....	.....	.....	.....	.....	34,759	41,486	29,223
General purpose containers	.....	.....	.....	.....	.....	.....	.....	83,072	4,989	5.734	6,109
Other glass products	6,176	3,459	3,372	4,611	14,811	1,694	1,885	6,133	4,752	5.110	6,347
Total value	56,540	79,607	92,095	123,085	261,884	210,305	304,769	285,978	276.330	299,716	207,042

[a] Data from U. S. Bureau of the Census.

TABLE 35.—QUANTITIES OF GLASS PRODUCTS BY SPECIFIED YEARS, 1899-1931 [a]
(In thousands)

Product	1899	1904	1909	1914	1919	1921	1923	1925	1927	1929	1931
Polished plate glass (sq. ft.)	21,172	34,805	60,151	75,770	72,849	[b]	124,780	165,380	157,546	148,743	88,017
Window glass (sq. ft.)	217,064	242,615	346,081	400,998	368,912	260,065	510,214	567,151	481,021	402,559	268,272
Obscured glass, cathedral, sky-light, opalescent (sq. ft.)	52,526	21,871	22,815	43,040	33,822	20,901	46,376	53,951	41,545	34,294	17,649
Wire glass—rough (sq. ft.)				13,981	14,462	13,949	28,802	28,743	25,795	38,924	14,216
—polished				1,708	1,229	2,211	2,805	4,165	3,320	3,893	1,448
Pressed tumblers and goblets (doz.)		7,346	11,687	18,030	25,182			29,678	27,281		8,939
Lenses, motor vehicle, (doz.)					726					2,321	1,398
Lamp chimneys (doz.)	6,901	7,339	6,653	6,989	6,615			3,439	2,987	3,019	1,597
Lantern globes	1,045	1,765	953	1,364	1,986			1,080	869	942	404
Tubing, pounds					18,147			16,860	21,519	23,067	17,292
Glass containers											
Milk bottles, gross								2,086	2,180	2,610	2,054
Narrow-neck blown bottles, packers ware, gross									3,301	2,956	2,784
Wide-neck blown bottles, packers ware, gross									6,299	6,489	6,269
Pressed ware (packers ware), gross									763	761	822
Fruit jars (home pack) gross								1,288	1,515	1,153	2,082
Beverage containers, pressure ware, gross									3,739	4,130	3,403
Beverage containers, non-pressure ware, gross									413	437	584
Medicinal and toilet preparation containers pressed and blown (gross)									12,097	15,792	12,062
General purpose containers, gross									4,223	1,358	1,048

[a] Data from U. S. Bureau of the Census.
[b] No data.

TABLE 36.—COMMON WINDOW GLASS: DISTRIBUTION OF THE DOMESTIC PRODUCT FROM THE PLANTS COVERED BY THE COMMISSION'S INVESTIGATION TO THE LEADING MARKETS IN THE UNITED STATES, 1929

Market	Shipments of domestic companies	
	Thousand pounds	Per cent of total
Atlantic and Gulf coasts:		
New York City and vicinity	61,519	
New York City	37,584	
Clifton, N. J.	15,061	
Jersey City	4,965	
Newark, N. J.	3,909	
Philadelphia	15,199	
Boston	9,356	
Baltimore	5,829	
New Orleans	2,424	
Houston	2,192	
Beaumont	181	
Other	41,136	
Total	137,836	32.5
Pacific Coast:		
San Francisco	8,072	
Los Angeles	6,260	
Seattle	2,371	
Other	4,502	
Total	21,205	5.0
Interior:		
Chicago	35,560	
Detroit	25,701	
St. Louis	14,199	
Pittsburgh	9,329	
Minneapolis and St. Paul	8,642	
Cleveland	8,397	
Other	163,237	
Total	265,065	62.5
Total to all markets	424,106	100.0

This represents about 75 per cent of the total value of glass products and may be considered as fairly indicative of the market distribution of glass products.

In comparison with the large market outlet in the cities of the Upper Mississippi Valley, the eastern states still lead in the manufacture of glass products.

For example, in 1933, the percentage of output, by value, of the leading states was as follows:

	Per cent
Pennsylvania	26.8
West Virginia	15.9
Ohio	13.0
Indiana	11.4
Illinois	7.5
New York	5.9
New Jersey	5.4
Others	14.1
	100.0

The number of factories by types of products in each of the important states is shown in Table 37.

TABLE 37.—NUMBER OF GLASS FACTORIES, BY TYPES IN LEADING GLASS MANUFACTURING STATES [a]

State	Pressed and blown glassware	Bottles and hollow ware	Window glass factories	Polished plate glass factories	Wire, opalescent, fancy figure, rough and ribbed glass tile factories
Pennsylvania	26	19	3	7	6
West Virginia	34	5	6	1	6
Ohio	16	4	4	3	1
Indiana	7	9	1	2	4
Illinois	2	1	..	1	..
New York	9	6	..	..	1
New Jersey	6	6	..	..	..
Missouri	..	1	..	1	1
Kansas	..	..	1	..	..
Oklahoma	3	7	3	1	1
Total	103	58	18	16	20

[a] Data from Glass Factory Directory, National Glass Budget, Pittsburgh, Pa.

The preponderance of glass manufacturing in eastern states is in part a consequence of the early development and location of glass manufacuring in the Atlantic Seaboard states. The westward movement of production lagged behind the migration of markets and tends to become more pronounced in machine methods of production which entail high capital costs. Nevertheless the constant drive to reduce costs must eventually take into account freight rates on glass shipments. The window glass market in Chicago, for example, is supplied mainly by plants in West Virginia, Indiana, and Ohio. The weighted average transportion charge on glass to this city is 43.7 cents per hundredweight.[2] This is

[2] Report to the President on Cylinder, Crown and Sheet Glass, Report No. 33, Second Series, U. S. Tariff Commission, 1932, p. 16.

roughly 12 per cent of the weighted cost of production of a hundredweight of glass, an item of cost which may well count in considering the advisability of relocating glass factories nearer the Upper Mississippi Valley market.

In addition to the large market for glass products and the unlimited supply of glass sand in the Upper Mississippi Valley, the introduction of natural gas into northern Illinois and the East St. Louis district has made this excellent glass-making fuel available.

AGRICULTURAL LIMESTONE

The upward trend in agricultural limestone distribution continued in 1934 over that of 1933 and 1932. Although consumption of agricultural limestone in 1934 has not returned to the level of the pre-depression years, nevertheless an increase of 81 per cent over 1933 is gratifying and indicates a return to normal limestone purchases by farmers.

Detailed statistics of distribution by counties were received from producers within the State and from producers in Indiana, Iowa, and Missouri who ship agricultural limestone into Illinois. These statistics were collected in cooperation with the Midwest Agricultural Limestone Institute.

TABLE 38.—TONNAGE OF AGRICULTURAL LIMESTONE USED IN ILLINOIS DURING 1933 AND 1934 AND SHIPPED TO OTHER STATES IN 1934

(Tons marketed in each county in Illinois)

County	1933 Total	1934		
		Produced in Illinois	Produced in other States	Total
Adams	183	7,587	.....	7,587
Alexander	.....	.....	.....	.....
Bond	941	1,769	.....	1,769
Boone	40	1,060	.....	1,060
Brown	267	918	.....	918
Bureau	611	1,004	42	1,046
Calhoun	.....	.....	.....	.....
Carroll	.....	.....	.....	.....
Cass	1,715	592	.....	592
Champaign	1,992	3,985	200	4,185
Christian	1,930	3,010	50	3,060
Clark	5,697	9,597	2,049	11,646
Clay	81	120	.....	120
Clinton	5,430	7,937	.....	7,937
Coles	519	637	895	1,532
Cook	811	2,615	.....	2,615
Crawford	630	553	210	763
Cumberland	832	2,053	594	2,647
DeKalb	1,011	1,138	.....	1,138
DeWitt	2,418	2,709	.....	2,709
Douglas	657	786	1,391	2,177
DuPage	954	567	.....	567
Edgar	1,594	1,875	1,651	3,526
Edwards	1,092	1,233	146	1,379
Effingham	2,259	1,058	3,142	4,200
Fayette	711	1,079	.....	1,079
Ford	1,196	3,023	666	3,689
Franklin	1,123	2,547	.....	2,547
Fulton	827	2,577	155	2,732
Gallatin	283	134	.....	134
Greene	7,745	11,046	.....	11,046
Grundy	657	1,483	.....	1,483
Hamilton	746	1,173	.....	1,173
Hancock	187	2,054	.....	2,054
Hardin	300	1,200	.....	1,200
Henderson	43	.....	.....	.....
Henry	3,617	3,911	4,978	8,889
Iroquois	3,500	2,772	2,869	5,641
Jackson	3,569	5,423	.....	5,423
Jasper	375	614	.....	614
Jefferson	590	1,073	228	1,301
Jersey	937	5,326	.....	5,326
Jo Daviess	.....	102	.....	102
Johnson	100	1,500	.....	1,500
Kane	1,357	1,923	.....	1,923
Kankakee	543	433	.....	433
Kendall	2,238	2,687	.....	2,687
Knox	1,091	2,555	2,241	4,796
Lake	264	1,237	.....	1,237
LaSalle	487	2,339	.....	2,339
Lawrence	245	326	1,198	1,524

TABLE 38.—TONS MARKETED IN EACH COUNTY IN ILLINOIS—*Continued*

County	1933 Total	1934		
		Produced in Illinois	Produced in other States	Total
Lee	92	614	.....	614
Livingston	4,154	4,625	.....	4,625
Logan	256	1,630	.....	1,630
McDonough	237	2,667	.....	2,667
McHenry	529	1,224	.....	1,224
McLean	4,204	18,100	13,495	31,595
Macon	1,451	2,976	369	3,345
Macoupin	3,616	15,891	.....	15,891
Madison	14,143	15,364	.....	15,364
Marion	1,947	1,554	1,092	2,646
Marshall	470	972	.....	972
Mason	3,438	2,352	.....	2,352
Massac	200	.....	.....	.....
Menard	609	671	.....	671
Mercer	362	384	2,671	3,055
Monroe	10,910	16,521	.....	16,521
Montgomery	2,465	3,236	.....	3,236
Morgan	1,121	3,226	.....	3,226
Moultrie	456	449	.....	449
Ogle	20	.....	.....	.....
Peoria	1,698	5,480	190	5,670
Perry	2,207	4,250	.....	4,250
Piatt	610	3,099	225	3,324
Pike	.....	770	.....	770
Pope	350	1,260	.....	1,260
Pulaski	.....	100	.....	100
Putnam	235	57	.....	57
Randolph	13,248	16,286	235	16,521
Richland	357	414	.....	414
Rock Island	2,909	1,683	1,933	3,616
St. Clair	16,884	6,362	.....	6,362
Saline	3,090	5,906	280	6,186
Sangamon	1,408	4,122	.....	4,122
Schuyler	457	170	.....	170
Scott	402	268	.....	268
Shelby	1,592	1,340	80	1,420
Stark	538	783	520	1,303
Stephenson	.....	900	.....	900
Tazewell	1,700	3,874	.....	3,874
Union	3,950	3,100	.....	3,100
Vermilion	947	1,631	805	2,436
Wabash	633	87	1,363	1,450
Warren	803	75	140	215
Washington	16,485	3,912	7,940	11,852
Wayne	301	304	150	454
White	1,317	177	1,870	2,047
Whiteside	718	2,134	32	2,166
Will	50	4,031	.....	4,031
Williamson	1,338	1,915	.....	1,915
Winnebago	.....	500	.....	500
Woodford	1,661	5,462	.....	5,462
County Unknown	.....	5,798	.....	5,798
Total	190,963	290,046	56,095	346,141

AGRICULTURAL LIMESTONE PRODUCED IN ILLINOIS AND MARKETED IN OTHER STATES

State	Tons	
	1933	1934
Wisconsin	0	85
Iowa	62	65
Missouri	80	2,232
Kentucky	0	0
Indiana	5,299	9,093
Michigan	421	1,546
Tennessee	730	238
Total shipped from Illinois	6,592	13,259

PORTLAND CEMENT

Portland cement shipped from mills in Illinois in 1934 amounted to 3,907,000 barrels, a decline of 286,048 barrels. Value of the product was $5,489,000, an increase of $881,665 and the value per barrel increased from $1.08 in 1933 to $1.40 in 1934.

TABLE 39.—SHIPMENTS OF CEMENT, IN BARRELS, VALUE, AND CONSUMPTION IN ILLINOIS, 1928-1934 [a]

Year	Shipments	Value	Average factory value per barrel	Consumption
1928	7,405,667	$11,602,848	$1.57	17,683,269
1929	7,738,208	11,134,538	1.44	13,490,520
1930	7,951,680	10,519,162	1.32	11,164,248
1931	6,425,909	5,342,446	0.83	7,925,435
1932	5,829,687	3,446,482	0.59	5,822,358
1933	4,193,048	4,607,335	1.08	5,281,216
1934	3,907,000	5,489,000	1.40	5,008,357

[a] United States Bureau of Mines, Monthly Cement Statement No. 164

TABLE 40.—PORTLAND CEMENT CONSUMPTION IN ILLINOIS, 1933-1934 (IN BARRELS) [a]

Month	1933	1934
January	71,367	133,420
February	115,629	99,658
March	125,846	183,486
April	171,203	386,683
May	177,861	671,643
June	347,314	557,475
July	1,124,429	512,159
August	996,408	545,571
September	881,269	546,926
October	665,137	736,326
November	295,027	476,070
December	309,726	158,940
Total	5,281,216	5,008,357

[a] United States Bureau of Mines, Monthly Cement Statements.

FLUORSPAR

Expanded activity at steel mills coupled with an increase in the average quantity of fluorspar used per ton of steel made, resulted in a consumption of about 20,600 tons more fluorspar by the steel industry in 1934 than in 1933. However, this increased consumption was not accompanied by a corresponding improvement in the sales of fluorspar, which were only about 9,600 tons more than in 1933, due to withdrawal from consumers' stocks.

The total sales of fluorspar to consumers in the United States in 1934 were 101,662 short tons, of which 85,264 tons were from domestic mines and 16,398 tons were imported.

TABLE 41.—FLUORSPAR SHIPPED FROM ILLINOIS AND KENTUCKY MINES, 1930-1934 [a]

Year	Shipments (tons)	Value	Average value
Illinois			
1930	44,134	$936,473	$18.95
1931	28,072	468,386	16.69
1932	9,615	156,279	16.25
1933	36,075	543,060	15.05
1934	33,234	567,396	17.07
Kentucky			
1930	39,181	836,473	18.95
1931	23,462	437,642	18.65
1932	14,975	225,052	15.28
1933	34,614	469,451	13.56
1934	43,163	690,990	16.01

[a] Data from U. S. Bureau of Mines, Mineral Market Reports, Fluorspar in 1934.

TABLE 42.—FLUORSPAR SHIPPED FROM MINES IN THE UNITED STATES, 1933-1934, BY KINDS [a]

Kind	1933			1934		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Gravel	61,216	$782,976	$12.79	74,249	$1,121,974	$15.11
Lump	2,127	34,401	16.17	3,101	60,135	19.39
Ground	9,587	221,801	23.14	8,436	209,296	24.81
Total	72,930	1,039,178	14.25	85,786	1,391,405	16.22

[a] Data from U. S. Bureau of Mines, Mineral Market Report, Fluorspar in 1934.

Stocks at mines.—The stocks of fluorspar at mines or at shipping points on December 31, 1934, consisted of 46,059 short tons of gravel fluorspar, 4,111 tons of lump fluorspar, and 416 tons of ground fluorspar, a total of 50,586 tons of "ready-to-ship" fluorspar. In addition, there was in stock piles at the close of 1934 about 33,300 tons of crude (run-of-mine) fluorspar, which is calculated to be

TABLE 43.—FLUORSPAR SHIPPED FROM MINES IN THE UNITED STATES, 1933-1934, BY USES [a]

Use	1933			1934		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Steel	60,279	$769,889	$12.77	70,672	$1,061,864	$15.03
Foundry	1,039	13,791	13.27	1,489	23,807	15.99
Glass	6,778	147,985	21.83	7,343	167,182	22.77
Enamel and vitrolite	3,100	76,932	24.82	2,590	67,849	26.20
Hydrofluoric acid and derivatives	950	18,604	19.58	1,666	35,708	21.43
Miscellaneous	713	11,010	15.44	1,504	26,393	17.55
Exported	71	967	13.62	522	8,602	16.48
Total	72,930	1,039,178	14.25	85,786	1,391,405	16.22

[a] Data from U. S. Bureau of Mines, Mineral Market Reports, Fluorspar in 1934.

equivalent to about 14,600 tons of merchantable fluorspar. These stocks compare with 44,777 tons of "ready-to-ship" fluorspar and 42,000 tons of crude fluorspar on December 31, 1933.

Imports.—The imports of fluorspar into the United States in 1934 were 16,705 short tons (10,632 tons containing more than 97 per cent and 6,073 tons containing not more than 97 per cent calcium fluoride) compared with 10,409 tons (5,165 tons containing more than 97 per cent and 5,244 tons containing not more than 97 per cent calcium fluoride) in 1933. The imports were equivalent to 19 per cent of the total shipments of domestic fluorspar in 1934 compared with 14 per cent in 1933.

Of the imports in 1934, about 35 per cent was metallurgical-gravel fluorspar, 11 per cent ceramic-ground fluorspar, and 54 per cent acid (chiefly lump) fluorspar. The metallurgical-gravel fluorspar was imported chiefly from Spain, followed in order by Germany, Newfoundland, United Kingdom, and China; the ceramic-ground fluorspar was imported chiefly from Germany, followed in order by Spain, Italy and China; and the acid-grade fluorspar was imported chiefly from Germany, followed in order by the Union of South Africa, Newfoundland, and Spain.

Table 44 shows the imports of fluorspar into the United States by countries in 1933 and 1934.

Table 45, compiled from data furnished by importers to the Bureau of Mines, shows the quantities of imported fluorspar delivered to consumers in the United States in 1933 and 1934 and the selling price at tidewater, duty paid, irrespective of the year of importation into the United States; it differs from the preceding table, which shows the quantities received in the United States during 1933 and 1934. The quantities given in the next table are based on the actual out-turn weight on which duty was paid and the entries were liquidated.

TABLE 44.—FLUORSPAR IMPORTED INTO THE UNITED STATES, 1933-1934, BY COUNTRIES[a]

Country	1933		1934	
	Short tons	Value	Short tons	Value
Canada[b]			187	$ 2,962
China	27	$ 413	112	990
France	204	1,247		
Germany	4,333	54,836	8,224	98,565
Italy	534	4,533	60	587
Newfoundland	320	2,646	745	10,460
Spain	4,261	28,690	4,914	35,316
Union of South Africa	713	12,449	1,997	31,872
United Kingdom	17	229	466	2,534
	10,409	105,043	16,705	183,286

[a] Data from U. S. Bureau of Mines, Mineral Market Reports, Fluorspar in 1934.
[b] Fluorspar imported from Canada originated in Newfoundland.

TABLE 45.—IMPORTED FLUORSPAR DELIVERED TO CONSUMERS IN THE UNITED STATES IN 1933 AND 1934

	1933			1934		
	Short tons	Selling price at tidewater, including duty		Short tons	Selling price at tidewater, including duty	
		Total	Average		Total	Average
Steel	6,208	$105,800	$17.04	5,394	$100,830	$18.69
Glass	1,288	33,160	25.75	1,257	36,120	28.74
Enamel	939	24,953	26.57	583	17,324	29.72
Hydrofluoric acid	3,971	90,313	22.74	8,982	217,650	24.23
Cement				182	4,100	22.53
Total	12,406	254,226	20.49	16,398	376,024	22.93

OTHER NON-METALLIC PRODUCTS

Detailed statistics of the use of sand, gravel, and limestone are given in Table 46, presented by districts as shown in figure 4. The decline in production which the industry has experienced since 1929 has been arrested and some of the uses of these non-metallics are again showing an upward trend.

TABLE 46.—PRODUCTION OF SAND AND GRAVEL AND LIMESTONE IN ILLINOIS BY DISTRICTS, 1932-1934

District Number (See Fig. 4)	1932		1933 [a]		1934 [a]	
	Tons	Value	Tons	Value	Tons	Value
Structural Sand						
I, II	332,486	126,317	242,395	114,680	409,945	131,288
III	148,380	61,189	123,767	58,830	214,153	136,076
IV	164,623	78,680	162,989	86,923	149,468	99,726
V	64,108	28,572	170,774	57,446	171,947	88,361
VI	33,956	10,132	24,443	7,973	6,530	5,206
Paving and Roadmaking Sand						
I, II	436,432	67,489	373,432	165,393	443,465	135,277
III	321,026	97,637	114,351	58,522	158,617	112,636
IV	392,388	159,931	311,061	156,236	268,313	130,162
V	135,588	58,905	191,587	60,341	131,000	63,800
VI	131,630	52,403	94,677	46,970	66,494	43,371
Structural Gravel						
I, II	446,665	179,678	246,330	122,369	516,740	178,502
III	188,693	92,368	124,107	62,809	248,688	160,979
IV	216,780	121,039	187,030	112,679	142,346	87,263
V	[b]	[b]	[b]	[b]	[b]	[b]
VI	17,884	10,049	15,774	10,507	20,016	10,359
Paving and Roadmaking Gravel						
I, II	1,164,801	461,497	730,143	336,305	689,622	243,690
III	509,921	253,704	215,251	110,171	295,436	160,138
IV	481,033	220,246	598,578	308,790	431,623	184,239
V	[b]	[b]	[b]	[b]	[b]	[b]
VI	122,638	57,494	104,819	70,333	60,363	49,336
Railroad Ballast Sand and Gravel						
I, II	534,019	140,828	246,640	102,784	361,503	151,084
III	70,170	10,563	16,660	8,290	5,630	2,815
IV	128,706	25,000	116,540	43,966	35,774	17,020
V						
VI	[b]	[b]	[b]	[b]	[b]	[b]
Other Sand and Gravel						
I, II	5,400	2,201	24,711	8,430	17,741	8,371
III	620,643	748,165	776,302	959,725	979,132	1,250,560
IV	17,864	14,461	28,762	21,836	20,028	22,703
V	16,025	8,780	[b]	[b]	[b]	[b]
VI	16,695	10,745	37,517	15,949	39,132	24,649
Total Sand and Gravel						
I, II	2,901,053	1,039,552	1,862,651	852,481	2,590,100	848,212
III	1,858,833	1,263,599	1,370,438	1,258,347	1,901,656	1,823,204
IV	1,420,144	623,107	1,404,960	730,430	1,047,552	541,113
V	233,174	111,199	379,462	130,998	329,686	170,089
VI	338,120	146,950	299,274	161,189	225,154	148,234
Illinois	6,751,324	3,184,407	5,316,784	3,133,445	6,094,148	3,530,852

[a] Commercial producers only.
[b] Concealed in total. Less than three producers.

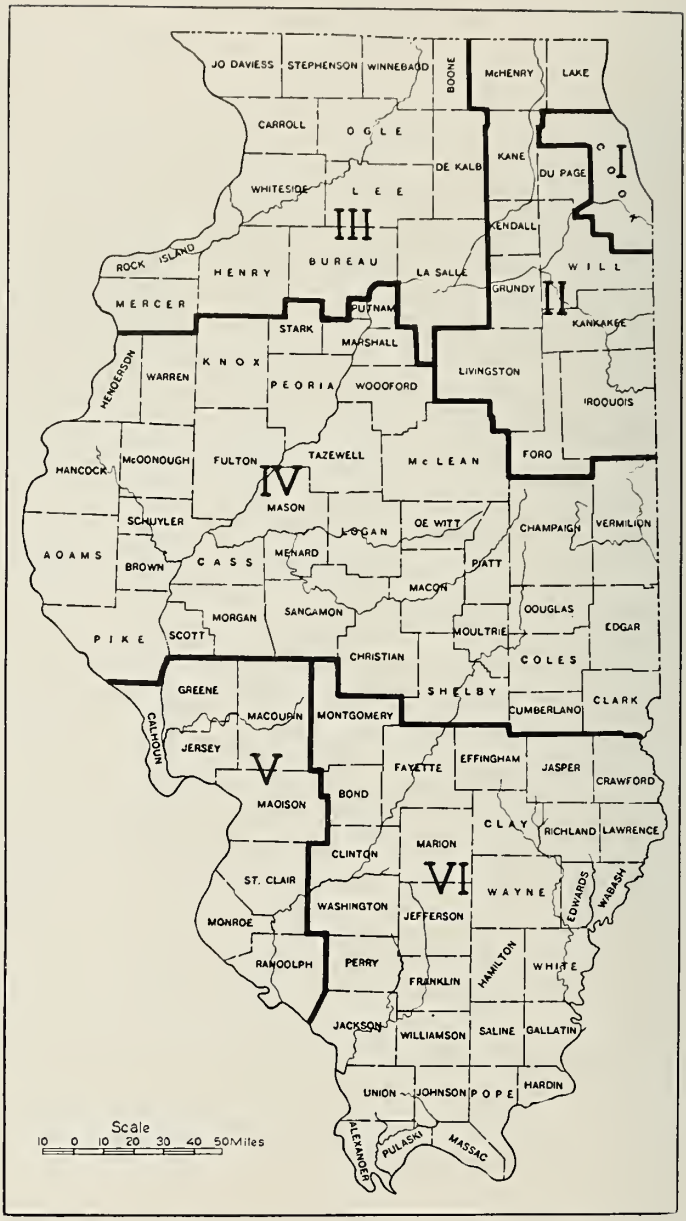

Fig. 4.—Index Map of Illinois Showing Location of Districts According to Which Production of Sand and Gravel and Limestone (Table 46) is Given

TABLE 46.—*Continued*

District Number (See Fig. 4)	1932		1933 [a]		1934 [a]	
	Tons	Value	Tons	Value	Tons	Value
Road Metal and Concrete						
I	1,047,230	576,057	702,241	403,662	1,102,415	693,510
II	517,255	365,548	410,816	290,973	515,687	370,156
III	91,410	82,855	45,142	36,000	119,533	109,939
IV	55,787	69,805	47,563	51,855	183,668	189,177
V	390,492	277,337	462,142	334,401	641,903	502,272
VI	174,950	145,800	91,582	84,647	104,036	98,349
Railroad Ballast						
I	69,764	42,630	(b)	(b)	96,467	51,234
II	58,833	41,718	64,753	47,693	119,648	89,633
III						
IV	(b)	(b)				
V	25,813	17,796	(b)	(b)	(b)	(b)
VI	(b)	(b)	(b)	(b)	(b)	(b)
Agricultural Limestone						
I	39,144	23,895	36,750	22,350	48,400	30,650
II	15,026	11,276	40,812	22,279	76,600	48,661
III	11,396	9,788	9,903	10,875	10,824	9,173
IV	15,380	21,061	14,621	17,434	59,543	47,208
V	65,919	58,222	104,818	75,651	223,596	131,267
VI	7,944	8,020	14,346	12,533	29,845	24,802
Flux						
I	83,589	49,874	130,800	71,880	251,800	142,250
II						
III						
IV	(b)	(b)	(b)	(b)	1,088	1,584
V	60,794	65,909	(b)	(b)	(b)	(b)
VI						
Rubble and Rip Rap						
I	20,875	22,625	19,450	19,200	(b)	(b)
II	(b)	(b)	(b)	(b)	(b)	(b)
III			(b)	(b)	(b)	(b)
IV	(b)	(b)	(b)	(b)	25,186	15,258
V	138,900	105,433	84,880	89,618	124,507	122,876
VI	(b)	(b)	(b)	(b)	(b)	(b)
Miscellaneous Limestone						
I	25,336	56,765	(b)	(b)	(b)	(b)
II	(b)	(b)	(b)	(b)	(b)	(b)
III	(b)	(b)	(b)	(b)	(b)	(b)
IV	7,574	23,421	(b)	(b)	8,949	25,321
V	8,249	24,145	9,774	37,544	7,296	26,470
VI						
Total Limestone						
I	1,285,938	771,846	954,541	557,492	1,618,389	1,029,048
II	598,358	424,547	523,362	355,328	718,100	518,873
III	103,056	92,753	55,725	49,450	131,627	126,624
IV	81,775	117,752	70,987	94,457	278,434	278,548
V	690,267	548,842	682,767	551,580	1,013,370	796,724
VI	205,914	177,342	109,979	100,943	141,640	131,834
Illinois	2,965,308	2,133,082	2,397,361	1,709,250	3,901,560	2,881,651

[a] Commercial producers only.
[b] Concealed in total. Less than three producers.